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THE NAVAL ARM OF DIPLOMACY IN THE FAR EAST

RUSSIA'S MILITARY FORCE

SIDESHOW IN BIG DRAMA OF EMPIRE

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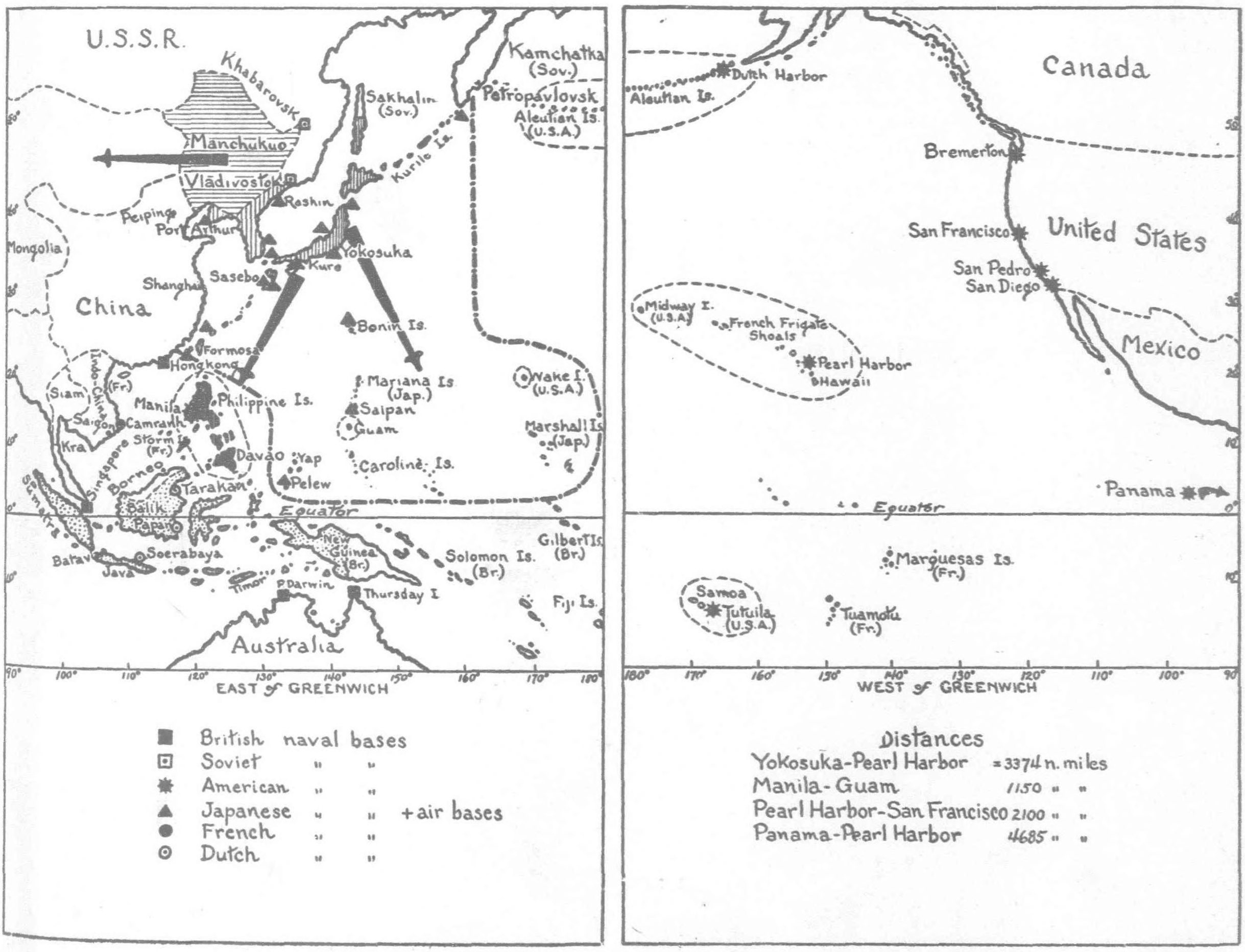
The Naval Arm of Diplomacy in the Pacific

By H. TH. DE BOOY, in "Pacific Affairs"

PERHAPS the most important single factor creating tension in the Pacific region is the teeming millions of Japan. Any summary of Pacific problems must therefore begin with a reference to the necessities of Japanese policy and the inevitable friction with other powers arising from them. Only 16 per cent of the land in Japan is arable. The position of the peasant class, forming about half of the total population, is desperate. Emigration to America and Australia is impossible, and emigration to countries under Japanese control can hardly be called successful. Perhaps the reason why the Japanese would prefer to settle in California, Brazil and Australia, instead of in Manchuria, is that their trend is toward Western ideas and Western standards of material comfort. Emigration, at any rate, is no solution for the population problem of Japan.

Industrialization is another matter. The success with which Japan has built up her industries must be acknowledged with admiration. The weak point in this industrialization is the lack of raw materials, which account for 60 per cent of Japan's total imports. Industrialization, moreover, is of no significance without an export trade, and Japanese commercial policy therefore inevitably causes difficulties with other countries. Heavy industry involves a demand for control of the areas from which raw materials



are obtained (Manchuokuo : iron and coal !) ; and trade involves a demand for the control of markets in which goods are consumed. This fundamentally is the explanation of the aggressiveness of Japanese policy.

Essential imports are iron, raw cotton, wool, rubber, timber, special steels, nickel, tin and aluminium; but it is sufficient to speak here of the strategic weakness of Japan's dependence on petrol and oil supplies controlled by other nations.

Japan consumed in 1933 about 3.6 million tons of oil fuel (an increase of about 250 per cent since 1926) and produced only 0.7 million tons ; and oil is of vital importance in modern war. Japan's battleships are more or less independent of oil, as they burn coal alternatively ; but cruisers, destroyers, submarines and air craft cannot do without liquid fuel. Of course enormous reservos have been accumulated, to assure at least temporary independence of foreign supplies in case of war ; but in the long run Japan must have oil or ask for peace. The United States and Netherlands-India are Japan's principal source of oil supply. As Commander H. Sato wrote in Brassey's *Naval and Shipping Annual* for 1927 : " One half of the oil import of Japan is drawn from the Dutch Indies ; the freedom of that sea route will be absolutely necessary for her power of resistance."

It is not enough, however, for Japan to have some degree of control over the sources of supply of the raw materials required by Japanese industry ; control of the consuming markets is also necessary. Japanese cotton textiles are chiefly exported to China and India, and therefore Japan's interest in Chinese trade is of obvious importance as compared with the American market for raw silk which although still of enormous value, is steadily decreasing in importance and cannot in any case be controlled by Japan.

In the light of these facts Japanese concern over the expansion of American trade in China is understandable. The *Japan Chronicle* of July 5, 1934, drew attention to the fact that America has now definitely displaced Japan as China's best customer, which is of special significance when it is remembered that trade with China amounts to only 3.5 per cent of all America's foreign trade, whereas Japan is genuinely dependent on trade with China. This, in the words of the *Japan Chronicle*, " is almost enough to justify the 'hands off China policy.' "

Netherlands-India and the Philippines are also markets of extreme importance for Japan. It is not without significance that some Filipinos do not look forward to their future independenee with excessive enthusiasm. As for Netherlands-India, its inhabitants have profited by cheap Japanese goods (the import of silk textiles into Netherlands-India increased from 2.2 million yen in 1926 to 14.3 million yen in 1932), but the Government was forced to take measures for economic self-defense.

In short, the control of sufficient export markets is really a matter of life and death to Japan. To protect the security of import and export trade, a strong " arm of diplomacy " is needed ; and as Friedrich Wilhelm I of Prussia once remarked, " *Wenn man etwas in der Welt will decidieren, will es die Feder nicht machen, wenn sie nicht von der Force des Schwertes souteniert wird.*" The pen must be supported by the sword. Japan can hardly be criticized for maintaining a huge army and fleet.

The possession of an effective army and navy does not imply that they have necessarily to be used belligerently—their silent pressure and potential menace are enough to heighten Japan's influence and prestige. It is true that this can be overdone. In 1930 about 27 per cent of the Japanese budget was spent on the army and navy ; in 1933 this had increased to 45 per cent, and the effect on the surrounding Pacific powers has inevitably been disquieting.

Japan emerged as the real victor at the Washington naval conference of 1921, and devoted the following ten years of security to the creation of a modern fleet. Without making a stir, ship after ship was put on the stocks, naval bases were erected or modernized and Japanese air power was improved. The first line of defense, running from Formosa to the Kurile Islands, now consists of naval bases and air bases in the Pescadores, Keelung, the Riu Kiu Islands, Nagasaki, Moji, Sasebo, Kure, Kagoshima, Yokosuka, Ominato, Mororan, Hakodate, Maidzuru, Shimonoseki and the Kurile Islands. From a naval point of view this line of defense is almost impregnable, as nearly the whole of the Japanese fleet can be concentrated in home waters.

The second line of defense is the strategic barrier of the Mandated Islands running southward from Bonin via Saipan to the Pelew Islands and eastward to the Carolines. The distance from the Pelew Islands to the nearest island of Netherlands-India is only 430 nautical miles. Under the League of Nations mandate entrusting the administration of these islands to Japan, fortification is prohibited, and Japan has denied that any fortification has been undertaken. Nevertheless the islands are of importance because they lie athwart America's principal trade route to the Far East. Submarines, destroyers and aircraft could use them as bases for raiding the commerce of an enemy or for operations to the south. The islands would also screen the Japanese fleet from the advance of a hostile fleet ; and they are admirably situated for protecting Japan's own trade routes, protection of which is just as necessary for Japan as for England.

Security for Japan in the outer Pacific carries with it security in the China seas. It may be that the Soviet Union has managed to bring submarines to Vladivostok ; but even so, Japanese naval superiority remains incontestable. The only real source of anxiety is in the untried potentialities of bombing from the air, by forces based at or near Vladivostok. Japan is building, not far south of Vladivostok, at Rashin, a great ice-free harbor which will be the terminal of the Tunhua-Kainei railway leading into the heart of Manchuria. Dairen, Fusan and Rashin, on the continental coast opposite Japan, will then provide strategic control of the economic life of Manchuria and Inner Mongolia.

It is often stated by naval experts that the strategic situation of Japan is almost perfect, and that even an attack by the combined British and American fleets could hardly be successful. This strategic strength Japan acquired largely through the Washington treaties, in return for renewed assurance of refraining from territorial expansion in China. The expansion into Manchuria which followed ten years later, in spite of this assurance, has allowed Japan still to retain this naval advantage—at least for the present. On the other hand, the effect of Japan's threat to throw off the shackles of armament limitation may be that wealthier naval powers will set out to build even more rapidly than Japan. This need not necessarily be the case. America for instance, never built up to the Washington limits, although this deficiency is now being made up.

From 1922 to 1933 Japan laid down about 150 warships totalling 400,000 tons, while America laid down only 44 ships, totalling 205,000 tons. Japan was thus able to attain a ratio of 10 to 7 in heavy cruisers, 10 to 9 in light cruisers, and a considerable superiority in destroyers and submarines. This armada not only makes possible a continental policy, but indirectly supports the policy of forced exports as well. When the British *Naval and Military Record** recently stated that Japan's unassilable position accounted for Great Britain's benevolent attitude after the occupation of Manchuria, it hit the nail on the head. Ten years ago the *Japan Chronicle*, writing on the subject of Japanese naval ambitions, said :

This great navy is to be built solely that Japan may be able to do things on the Asiatic mainland and present them to the world as accomplished facts without running the risk of the Powers offering " advice " such as they offered in 1895 (Liaotung). The expansion of the navy is not for the purpose of being aggressive, but for the purpose of deterring protests if aggressive action should be for any reason committed.†

The danger inherent in Japan's policy is that the number of reasons for aggressive action increases rather than diminishes with the success of the policy itself. It is necessary to summarize the essentials of this policy, because Japan is the primary active factor in the creation of the Pacific problem. The measures of the other Pacific powers are in the main reactions to the industrial and continental expansion of Japan, which threatens to end the *status quo* ; the chief aim of the *status quo* being, according to popular opinion in Japan, to protect the interests of the white races only. The powers concerned are Great Britain, America, the Soviet Union, France and Holland, all of which have possessions or essential interests in the Pacific.

The extreme vulnerability of Great Britain in the Far East necessitates a cautious foreign policy. For this reason the friendship of Japan cannot be disregarded, as Japan indirectly protects British interests against the spread of communism ; and ever since 1925, Great Britain has acted as if there were a kind of secret gentlemen's agreement with Japan. Great Britain, however, is also sensitive to American interests on the continent of Asia, and both nations would suffer if the influence of Japan were free to spread unchecked. Great Britain, therefore, of necessity maneuvers between Japan, the Soviet Union, China and America.

*London, December 28, 1933

†Cited in *Navies and Nations*, Hector C. Bywater, 1927, London

British trade routes to the Far East converge at Singapore, and as 90 per cent of the rubber, 89 per cent of the wool, 86 per cent of the nitrates, 71 per cent of the tin and 25 per cent of the liquid fuel imported by Great Britain come from that part of the world, it is plain that the Singapore naval base cannot be regarded as intended for securing the safety of Australia only. As Lord Grey put it before the House of Peers some twelve years ago, the only reason for a naval base at Singapore is the ultimate possibility of war with Japan. Undoubtedly this naval base improves the British position ; it allows full use of the naval arm of diplomacy in the Far East.

For the defense of British interests in China, Hongkong would have been a far better stronghold than Singapore ; but the 5 : 3 ratio with Japan was bought in 1922 at the price of refraining from further fortification of potential bases in the Pacific, and the idea of making Hongkong impregnable had to be given up. The skilful maneuvering of Great Britain in the effort to retain both the Chinese market and the imperial hold on India, and to improve the defense of its key position on the edge of the Pacific and appease Australia without antagonizing either Japan or America, demands admiration. Moreover, the British position has been maintained in spite of a decrease of 47 per cent in naval strength since 1914, while in the same period the American navy has been increased by 29 per cent and the Japanese navy by 37 per cent.

The cutting of Far Eastern trade routes would not be mortal to America, which has no colonies on the Asiatic continent, and does not need to fear the spread of communist influence as Great Britain does. Apart from the undoubtedly idealistic or sentimental motives underlying America's policy in China, however, there is an actual American investment in China of 250 million dollars, and the potential future value of the market in China for American goods is considerable. This explains America's sharp reaction to Japan's Manchurian policy ; for the Open Door policy is based on an expectation of future benefits, and whenever the Open Door is threatened America is bound to protest.

Whether such protests can be made effective is another question. The enormous distance from Pearl Harbor, in Hawaii, the principal base of the American fleet in the Pacific, would make a naval demonstration against Japan extremely hazardous. America exchanged the right to strengthen Guam, which could have been made the true key to the whole Pacific, for renewed international assurances that the integrity of China would be respected. This involved the abandonment of the only base from which American naval power could have made itself felt in the western Pacific.

American commitment to the future independence of the Philippines, which is not properly speaking due to American foreign policy but the result of pressure from agricultural and financial interests within America itself, has further weakened the American position in the Far East. It may be that the security of the Philippines has always depended on the good-will of Japan rather than the power of America ; but this exposed position has been obvious from the first. As a result of the Washington Conference, America was debarred from improving the defenses of Manila, but nevertheless the defenses previously existing have been retained. " Without a base in the Philippines, the voice of America becomes distant and weak in the Pacific," wrote Mr. Stimson three years ago.* At first glance it might appear that by relinquishing the Philippines America might be able to curtail its naval forces in the Pacific and avoid possible causes of war ; but, as Nicholas Roosevelt has pointed out, " this ignores the fact that support of the Philippines is not the only interest of America in the Far East."†

It is no wonder that the American decision to throw off the " white man's burden " was welcomed in Japan. It completely suited the Japanese policy of commercial expansion. It is equally plain, however, that the future fate of the Philippines is awaited with no small anxiety in Netherlands-India. The idea of American possessions lying between Borneo and Japan gave a sense of security to Netherlands-India which a Filipino State, unavoidably destined to come under Japanese influence, cannot assure.

It is difficult to understand what underlies the present American naval policy. The demand formerly was for a navy second to none, able to defend the freedom of the seas and adequate to the national needs. The navy required ships with a wide cruising radius, owing to the lack of overseas bases, and to the necessity for making American naval power a factor to be taken into account all over the world, capable of supporting American foreign policy. Yet at present, while America seeks no new spheres of special interest, it demands a navy " equal to the most powerful," if only to ensure protection for foreign trade. According to Lieutenant C. G. Moore, U.S.N., writing in Brassey's *Naval Annual* for 1931, America " owes it to world peace to have a navy which will ensure world stability." It is hard to reconcile this attitude with the abandonment of the only possible base in the western Pacific. No wonder that Mr. Saito, Japanese Ambassador at Washington, opposed the American claim to a 5-3 naval ratio on the ground that since America is now committed to the independence of the Philippines, it is no longer necessary to retain a navy strong enough to defend the Philippines.‡

The situation at present is that the naval strength of America cannot make itself felt with full effect at a distance of more than a thousand miles west of Hawaii. Notwithstanding a numerical superiority in battleships and cruisers, it would therefore hardly be possible to defend American interests in China in case of a conflict with Japan, while a direct attack on Japan would be quite out of the question. If, on the other hand, the American navy were designed for no other object than defense of the American coasts, the present naval strength could safely be reduced.

America's naval policy, like that of other nations, has had its ups and downs. The advocates of a stronger strategic position have repeatedly drawn attention to the vulnerability of America's trade routes in the Far East. Captain Dudley Knox, U.S.N., in the *Proceedings* of the United States Naval Institute,§ has urged the idea of acquiring the Marquesas and the Solomon Islands as " stepping stones " across the Southern Pacific, in exchange for French and British war debts. At present the only American fueling base on this southern route is Tutuila, in the Samoan group, but more bases would be necessary to extend the route to the Far East, avoiding the Japanese Mandated Islands by running to the south of New Guinea. It does not seem probable, however, that France and Great Britain would be willing to exchange colonial possessions for cancellation of war debts which are already in default.

In the meantime, a northern American route to the Far East is being developed. A naval base will be constructed at Dutch Harbor on the coast of Alaska, and the Aleutian Islands have been extensively surveyed. An air route westward from Dutch Harbor would not be impossible, and might become a real menace to Japan. The distance from the western Aleutian Islands to Pearl Harbor in Hawaii is 2,500 nautical miles, while the distance to the nearest Japanese bases is only 1,500 miles. At present the American navy, while below the treaty standard, is rapidly being built up and is likely to reach treaty strength within a few years. With first class bases at San Diego and San Pedro in California, Colon in the Panama Canal Zone and Pearl Harbor in Hawaii, it is supreme between Hawaii and the West Coast.

Without adequate advanced bases, however, it would be extremely difficult to make the navy effective in the western Pacific. Inability to use the fleet as a naval arm of diplomacy has been widely interpreted as one reason for the rapprochement between America and the Soviet Union. The increasing naval power and impregnable defensive position of Japan had threatened to upset the naval balance of power, and it may be that the increasing strength of the Soviet Union in the Far East, and its efforts to consolidate its position as a Pacific power, will restore the balance by keeping Japan in check.

It is ironical that the Soviet Union, once feared as the agent of international revolution, should have come to be the central nervous system of world peace. The Soviet Union is hardly to be counted as a naval power in the Far East, but its indirect influence on the balance of power in the Pacific is so considerable that its policy in eastern Siberia, which is clearly hostile to Japan, needs comment. The weakness of the Soviet Union lies in the isolation of Vladivostok. In the endeavor to make up for this weakness Khabarovsk, 400 miles north of Vladivostok, on the Amur, has been made the main military base. Immense oil refineries and large iron foundries and steel works are under construction. Aircraft and troops have been concentrated in this area and everything is being done to improve communication westward from Khabarovsk. The steel and munition works at Kuznetsk and Magnitogorsk, farther west in Siberia, may already be considered important political factors ; even the scientific expeditions looking for a northern sea route

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*Letter of Mr. Stimson to Senator Bingham, 15 Feb., 1932, published in *Proceedings*, U.S. Naval Institute. . . . June, 1932

†Roosevelt, *The Restless Pacific*, New York, 1928

‡*Japan Chronicle*, Kobe, July 26, 1934

§May, 1932

to the Pacific via Kamchatka cannot be overlooked when considering the possibilities of military preparation.

When, in the near future, Soviet industries have developed to the point where they can sell goods in increasing quantities on the Far Eastern market, tension with Japan is likely to increase. Improved industrial strength will mean greater ability to thwart Japanese expansion both on the Vladivostok frontier and on the Mongolian frontier of Manchuria ; and fishery disputes with Japan in the northern Pacific, together with the prolonged negotiations over the sale of the Chinese Eastern Railway, will certainly not decrease the conflict of interests.

The position of France, as a colonial power with valuable possessions in Asia and important vested interests in China, is analogous with that of Great Britain. France also is perturbed by the increasing influence of communism, and is therefore likely to be sympathetic toward any Japanese policy which can be regarded as checking the spread of communism in Asia. The paradox inherent in the French Far Eastern colonial policy is that French support in the West has enabled the Soviet Union to take a stronger attitude toward Japan in the East. The entry of the Soviet Union into the League of Nations, which from the beginning has been supported by France, has in particular accentuated the isolation of Japan.

The defenses of Indo-China have recently been strengthened. The French flag has also been raised on the Storm Islands, between the Philippines and Indo-China, in spite of Chinese and Japanese protests. Plans are ready for the construction of a naval base, especially for submarines, near Cam Ranh, on the coast of Annam, midway between Hongkong and Singapore, while Saigon is to be made a base for naval planes. It is also rumored that the fuel capacity of Tahiti and Papete will be improved ; but the sea power of France is concentrated in the Mediterranean and Atlantic, and the political situation in Europe would have to be very satisfactory indeed before France could send battleships and cruisers east of Suez for the defense of Indo-China. The actual French naval strength in the Far East consists of a cruiser and some gunboats, submarines and aircraft. These have a considerable preventive value and thus influence the naval balance of power in the Pacific ; but the position of France in the Far East is on the whole of secondary importance, the security of the mother country and the African possessions having priority over all other interests.

Netherlands-India, as the principal colonial possession of Holland, is of such vital importance that Holland's position in Europe must stand or fall with the mastery of these islands. Lying on the border of two oceans and containing natural riches of the utmost value, they are a prize well worth fighting for. If Holland should lose control of them it would mean an end to the balance of power in the Pacific as it now exists, for Netherlands-India dominates communication between the Indian Ocean and the Pacific. The only possible policy for a small country like Holland, unable to support its foreign policy with the naval arm of diplomacy, is to avoid committing itself to foreign entanglements and to keep a strict neutrality in the event of a conflict between other Pacific powers.

For this reason rumors of an alliance between Great Britain and Holland must be dismissed as unfounded. Such an alliance would be absolutely contrary to the historical and consistently maintained policy of Holland. It cannot be denied, however, that Dutch interests are inseparable from British interests. The East Indian archipelago forms a bridge between Singapore and Australia, and it would be difficult to imagine that Great Britain would ever consent to allow the archipelago to fall into the hands of, for instance, Japan.

The Open Door policy of the Dutch government has resulted in large investments of foreign capital in Netherlands-India. The continuation of Dutch rule is therefore a matter of prime importance to several other powers, especially as the ability of Dutch administration is generally acknowledged. It is impossible to deny that the commercial expansion of Japan, supported by pan-Asiatic propaganda and demonstrations of military strength, has caused anxiety in Netherlands-India, where Japanese imports have increased with astounding rapidity and have in a few years reduced Dutch imports to second place. As the general economic depression has been felt with special intensity in Netherlands-India, owing to the inability to export sugar, rubber and other raw products at a profit, cheap Japanese goods have undoubtedly been a boon to the native population. The resulting increase in Japanese popularity has been exploited by Japanese agents in the effort to cultivate an anti-Dutch sentiment in Javanese nationalistic circles.

It is obvious that the neutrality of Holland in the event of a conflict in the Pacific would be in imminent danger of violation. For Japan, maintenance of overseas trade during a war would be a matter of life and death ; and as trade could not be maintained without control of the passages from the Pacific to the Indian Ocean, Japan might feel constrained to occupy temporary bases on Dutch territory. It might be possible for Holland to solve the problem of furnishing oil fuel to belligerents in a Pacific war without abandoning political neutrality. The Dutch government, however, must take into account the possible failure of such a policy, and it has therefore made preparations in advance for the timely destruction of the oil plants at Tarakan and Balik Papan in case of necessity.

The main fleet of Holland consisting of two cruisers, eight destroyers, twelve submarines, several mine-layers, two gunboats and a number of naval planes, is concentrated in Netherlands-India, the principal naval base being at Soerabaya. The principal function of the navy in case of war would be the maintenance of neutrality ; while the army, which is chiefly concentrated on the island of Java, would be expected to defend the land approaches to naval bases and other critical points, such as the fueling plants at Tarakan and Balik Papan, against the possibility of sudden raids by the cruisers of one of the belligerent nations. The Dutch naval policy is based on the conviction that it would be impossible to maintain a navy capable of defending Netherlands-India against a sustained attack. Holland is therefore forced to take the risk of relying on a fleet, the strength of which is calculated in terms of the difference between the naval strengths of the principal Pacific powers. The navy of Holland, in other words, though it may seem insignificant in itself, in comparison with the fleets of Japan and America, has a strength which is out of proportion to its actual size, inasmuch as it might be able to turn the scale as between the naval forces of any other two nations.

One of the terms of the naval treaties following the Washington Conference demanded the scrapping of obsolete ship. This was of special benefit to Netherlands-India, where it had always been feared that one of the major naval powers might be able to make use of its obsolete ships for a secondary expedition to Netherlands-India. Since obsolete ships can no longer be retained in service, the preventive strength of a small but efficient modern navy in Netherlands-India is very greatly increased, because it would be necessary for an aggressor to detach vastly superior naval forces in order to ensure success, especially as a raiding squadron would have to operate beyond comfortable range of a supporting base. It could hardly be expected that in the event of a war in the Pacific the Dutch naval forces would be able to guarantee complete security against infringement of neutrality in the enormous area which they would have to patrol. Nevertheless, the reserve strength of the Dutch Far Eastern squadron as a potential ally or enemy would serve to deter belligerents from hostile acts against Netherlands-India.

While the ultimate possibility of a war in the Pacific cannot be ignored, it is unwise to forget that a peaceful solution of contemporary conflicts of interest is quite possible. In this connection it is gratifying to note that responsible Japanese statesmen have seen the necessity for a better understanding with the United States and Great Britain. For the Western powers, however, whose chief problem is the effort to keep up their standards of living, the outlook is full of anxiety. They have to deal with the fact that Japan is growing in self-assurance politically as well as economically, and that while Japan is undermining the Western nations economically, it protects them politically against the spread of communism. The *status quo* in which the Western powers are so vitally interested is, in the ultimate analysis, a balance between communist expansionism on the continent of Asia, and the economic imperialism of Japan, which is intimately dependent on naval power. To the maintenance of this balance no nation is more sensitive than Holland.

The recent naval conversations were in effect a battle in which guns were matched against each other without actually being fired, and in which each power tried to cut down the naval strength of its opponents, and at the same time to strengthen its own position. It is a great pity that questions of national " face " and dignity are unavoidably involved in such conferences, because these delicate questions enhance the difficulty of frank and realistic discussion, and thus increase the chances of a breakdown, in which the peace of the Pacific is at stake.

Russia's Military Force

By WALTER DURANTY, in the "New York Times"

THE attention of the world has been attracted to the Red Army by the recent announcement of Vice Commissar of War Tukhachevsky that its strength had been increased by 56 per cent in the past year, and by the fact that Germany used this increase as a pretext for the introduction of universal military service.

In regard to the Red Army there are four points of especial interest, three pluses and one minus, as follows:

First—It is the largest standing army in the world, with a peace-time force of 940,000 men. This figure probably, although not certainly, does not include what were formerly called Ogpu troops, namely, railroad and frontier guards and special detachments for service in the large cities (once called "Special Protection Troops," who are long-term enlisted men and may total from 150,000 to 250,000; they correspond to the "green" and "blue" police in Germany).

Second—The Red Army is now highly mechanized and well equipped, and appears to be efficient and well disciplined. But—

Third—There is a general weakness of transport in the Soviet Union.

Fourth—The Red Army is exceedingly popular and privileged, and is a school and training for life as well as an army.

The Red Army

The Red Army was founded by decree of January 15, 1918, originally as a volunteer service. Conscription was introduced on June 17 of the same year as a result of the Czechoslovak revolt and the Japanese landing at Vladivostok, and has remained in force ever since. A subsequent decree (August 8, 1928) made military service obligatory for all able-bodied males between the ages of 19 and 40, with exceptions for disfranchised persons, criminals, priests, sons of former nobles, landlords and gendarmes.

Service is divided into three sections: preliminary training, active service with the colors, and reserve. Recruits are not called up until they have passed their twenty-first birthday. Their term of service varies from two to four years, according to the branch of the army to which they belong.

The reserve is divided into two sections, one composed of those from 23 to 34 years old and the other of those from 35 to 40. Reservists in the first category do from one to three months' service annually, and in the second category from two to six weeks, but as the army is organized primarily on a territorial basis, reservists, with certain exceptions, generally perform their annual service in the neighborhood of their homes.

Officers, as in other Continental armies, are almost wholly "career" soldiers. Originally they were provided by training schools on the Western model, but every encouragement is given to the rank and file to enter such schools, or to attend special classes outside the schools, in order to rise to officer rank. The High Command, Staff College, and so forth, difter little from foreign systems, but there is one important feature of the Red Army which is unique, namely, the Political Administration.

The importance of the Political Administration may be judged from the fact that its present chief is Gamarnik, Vice Commissar of War and therefore equal in rank to Tukhachevsky—that is, only second to the Commissar, Voroshiloff. It includes the function of military intelligence, but has in addition what is here considered the even more vital task of organizing and supervising the political, mental, moral and, for that matter, physical training of the army from top to bottom.

Chief stress is laid on the political features for two reasons, one of which belongs in the present, the other in the past. As war clouds loom darker, the elite of the nation is being progressively drawn into the army (it must be remembered that not more than a third to a quarter of the available recruits are called for service each year, which gives wide scope for mental and physical selection), and it is imperative that this elite should be Communist by conviction, should fully understand the aims and ideals of Marx and Lenin which Stalin is putting into practice.

Old Regime Officers

In the past, during the civil war and intervention period, the Red Army, like the first forces of the French Revolution, was compelled, through lack of officers of its own, to employ to a considerable extent the services of officers of the old regime, about whose loyalty there was often grave cause for doubt. And, like the French Revolutionaries, the Bolsheviki tried to remedy this defect by establishing a corps of civil "Commissars," who in the final instance had powers of life and death over the "White" officers. This system of divided control, naturally, worked badly, and it was felt necessary to lose no time in forming a corps of Communist officers.

This purpose was, however, secondary to the Political Administration's essential function, which is that of developing and co-ordinating the Communist party movement in the Red Army. From a party point of view, the Red Army is in a sense "extra-territorial" (the word is actually used in the party statutes on the subject); that is to say, it has its own "cells" and party organization separate from those of civil life. When, therefore, a Communist worker, affiliated with a party unit in a Moscow factory, joins the army he severs for the time being connection with that unit and enters a new military unit.

The army to-day is 50 per cent Communist. It may be reckoned that recruits on entering are from 25 to 35 per cent Communist or Young Communist members. On expiration of their term of service the percentage has risen to 60 or more. Almost 70 per cent of the officers are party members, while the higher ranks are almost exclusively Communist.

The correct title of the Red Army is Workers and Peasants Red Army, generally abbreviated to RKKA, from the initials of the Russian words in the name. Its composition at present is 40 per cent workers and 60 per cent peasants, and of the latter nine-tenth are drawn from collective farms. Its purpose was initially defined by Lenin as follows: "To learn the art of war, so necessary for the proletariat, not in order to shoot its brothers, the workers of other lands, but to put an end to exploitation, poverty and wars."

Ten years later Stalin thus elaborated the three "particularities" of the Red Army:

(1) The RKKA is the army of freed workers and peasants of the Dictatorship of the Proletariat to maintain the power of the Proletariat against landlords and capitalists, whereas in all other countries the army is the weapon of capitalist exploitation.

(2) The RKKA is an army of defense against capitalist aggression, whereas foreign armies are the tools of such aggression against weaker countries and colonial populations.

(3) The RKKA is trained in the spirit of international brotherhood, whereas capitalist armies are imbued with nationalism, to hate other peoples' governments and even the workers of other lands.

Every 1st of May at the Red Army parade in the Red Square, which precedes the mass demonstration of workers, the assembled troops shout in chorus the following oath, which is taken by every Red soldier on joining the colors:

> I, son of the working people, citizen of the Union of Soviet Socialist Republics, take upon myself the calling of soldier in the Workers and Peasants Red Army. I promise at the first appeal of the Workers and Peasants Government to march to the protection of the Union of Soviet Socialist Republics.

It is extraordinarily impressive to hear the sonorous words of the oath shouted by 30,000 throats and school back from the steep outer wall of the Kremlin.

The Governing Body

The governing body of the army is the so-called "Revoyen Soviet," which means Revolutionary War Council, whose president, Voroshiloff, is Commissar of War. Its vice presidents are Tukhachevsky, Gamarnik and S. S. Kameneff (the initials are always used to distinguish him from Trotsky's back-sliding brother-in-law), who all rank as Vice Commissars. Other notable members are Yegoroff, Chief of Staff; Alksmis, head of aviation; Eideman, president of Osaviakim (the Soviet Air League, which now has more than 15,000,000 members); Budyonny, the popular cavalry leader, and, last but not least, Orjonikidze, Commissar of heavy Industry.

Last December the Revoyen Soviet was increased from fourteen to eighty members, including practically all of the high staff officers and district commanders, and its title was changed to "Soviet Oborony," meaning Council of Defense, with the "Revolutionary" makes the governing body unwieldy and augments the authority of the War Commissar, the Vice Commissars and the Chief of Staff.

In time of war the high command would be in the hands of Voroshiloff, but it is unlikely that he would act as field commander. It is the usual practice of Continental armies that their Chief of Staff is named field commander in wartime, but in the case of the U.S.S.R. it is not improbable that this position would be entrusted to Tukhachevsky, who is recognized, both by Russians and by foreigners, as the foremost military mind in the country. Tukhachevsky commanded the Red forces in the Polish War at the early age of 26.

Efficient Army Staff

The question has often been raised abroad as to how far the staff work of the Red Army is efficient. Foreign critics are ready to admit that a "new" army can be equipped and trained in a relatively short period, but they are inclined to deny that there can be any improvisation in the organization of a staff college and its instructors and in the highly technical education to be imparted. Nothing could really answer this question but the test of war.

It is, however, a fact that the high command of the Red Army is composed of comparatively young men who are fanatically eager to learn and who work harder than officers of corresponding rank in any other army. Tukhachevsky, moreover, is the author of books on strategy and tactics which have been highly acclaimed by military authorities abroad.

Finally, in practice, the Red Army "demonstration" in Manchuria in the Fall of 1929, at the time of the dispute with the then war lord, Chang Hsueh-liang, about the Chinese Eastern Railroad, was an example of first-class staff work. It is true that there was little or no resistance, but the accurate co-ordination of infantry, cavalry, artillery, tanks and airplanes over several hundred square miles of difficult territory was recognized by foreign military experts as denoting staff work of no mean order.

Another question of interest is whether any foreign officers are instructors in the Red Army. It is beyond doubt that several years ago, during the period of the Russo-German friendship, active officers of the Reichswehr were detached for special service in Russia, principally in the realms of artillery, aviation and chemical warfare. It is possible, too, that higher German officers were similarly employed in the Soviet Staff College. But I question whether there are any strictly foreign officers of any importance in the Red Army to-day.

Mechanized Fourfold

Tukhachevsky told the All-Union Congress that the Red Army had been mechanized fourfold in the last four years. And it had been declared earlier that it was twice as much mechanized as any other army in the world. It is impossible to gauge the truth of these assertions because the figures which Tukhachevsky proceeded to give in support of his statement were all in percentages—that is to say, that aviation had increased 330 per cent, baby tanks, 2,475 per cent, light tanks 760 per cent, medium and heavy tanks 792 per cent, infantry machine-guns 200 per cent, aviation and tank machine-guns 450 per cent, heavy artillery 200 per cent.

One thing, however, these figures do indicate, as was pointed out to me by a highly competent foreign military authority; they show at least that the equipment of the Red Army is well balanced according to modern ideas of the best military tactics. A few months ago a large album of superb photographs was issued to commemorate the fifteenth anniversary of the foundation of the Red Army. It shows every variety of mechanical equipment used by foreign armies, including a "fleet" of amphibian tanks swimming across a lake.

The most obvious factor in favor of Soviet claims for the great increase in mechanization of the army during the past four years is that in that period the production of iron and steel has tripled, and that the huge new factories which were nearing completion four years ago are now running full-blast at the peak of production (for a month or more the daily production of iron and steel has been surpassing the program). Similarly, there have been erected and are now at full production a number of great chemical plants for the manufacture of gas and high explosives.

It is a significant fact that most of these new plants are situated in the middle of the U.S.S.R.—in the region 200 miles west and 800 miles east of the Ural Mountains. They are thus completely beyond the range of attack by present-day aircraft. It is no secret that the necessity to construct plants in this region, owing to the increased danger of war, was one of the reasons why the first Five-Year Plan, which thus had to be modified, failed to reach schedule in certain important respects. These deficiencies have now been overcome.

Aircraft Production

In regard to aircraft production, it is worth while to cite the opinion of no less an authority than Thomas A. Morgan, Chairman of the Curtiss-Wright Corporation, who after seeing more of Soviet aircraft factories than any other foreigners, told me last Summer that this country was then in a position to build aircraft on a real mass-production scale—on a bigger scale, he said, than any other country in the world at present. Mr. Morgan added that of course the United States, and for that matter some of the European countries, could no doubt soon mobilize their factories to produce on a larger scale still, but for the time being, he thought, the U.S.S.R. was in the lead. What was more, he said, planes were now being built with Soviet materials.

Foreign military experts here, many of whom have attended Red Army manœuvers, are generally agreed that the army is as highly mechanized as is claimed, that its personnel is well equipped and disciplined, and that the handling of troops in the field leaves little to be desired; in short, that it is a highly efficient fighting force. But they are inclined to make reservations with regard to transportation.

The Transport

The weakness of the Soviet transportation system is too notorious to require any elaboration. The appalling figures for train wrecks and damage to locomotives and cars recently issued by the new Railroad Commissar, Kaganovitch, no less than the fact that daily freight-car loadings are not yet up to the program figure set for October, 1932 (which, however, was speedily reduced), are evidence that cannot be controverted. Despite a considerable amount of new railroad construction, it may be said that whereas the industrial production of the U.S.S.R. has tripled or quadrupled in the past five years, railroads have not advanced more than 10 or 15 per cent in the same period.

Soviet soldiers are fully aware of this weakness. Indeed, Tukhachevsky advanced it as one of the principal reasons why it was necessary to increase the army from 600,000 to 940,000 men, it was impossible, he said to "shuttle" troops from east to west or *vice versa*, as Germany had done in the World War, and therefore it had been found necessary to build permanent fortifications on both western and eastern "fronts" and garrison them with large effectives.

The Far East Army

In the case of the Far Eastern army it is hoped to overcome the transport difficulty by making the army "autonomous," that is, to pile up a sufficient quantity of supplies of all kinds beforehand and thus enable it to go on fighting a long time without putting undue strain on the transport system that at best is poor, and in addition is liable to be cut by the enemy.

In the West, where danger now seems more imminent, it is probable that something of the same kind is being organized at a convenient distance from the possible scene of action. Tukhachevsky said frankly that here, too, powerful fortifications had been constructed, and unless I am mistaken the permanent effectives on the western "front" now considerably outnumber the Far Eastern army.

This, however, say foreign military experts, does not by any means dispose of the transport problem. The very fact that the army—and for that matter national agriculture also—is now so highly mechanized makes a breakdown of transport, which would carry oil and other supplies, all the more dangerous. In the old days when every second peasant had a horse and cart it mattered less, but tractors and trucks cannot move without gasoline. These foreigners point out also, that, whereas Germany has made enormous progress in road-building, the same cannot be said of the U.S.S.R., and they suggest that the comparative roadlessness of the wide Russian steppes, which hitherto has been a source of protection, might in a conflict with Germany turn to Russia's disadvantage.

Proud and Happy Soldiers

The Bolsheviki assert, I think with justice, that the Red Army is the only conscript army whose rank and file are proud and happy to be soldiers, who feel that it is a privilege to serve their country as soldiers. Not only the troops themselves but the mass of the Soviet population regard service in the army as an honor, no less than a duty.

This is no mere boast on the part of the Bolsheviki but an undoubted fact, and its reasons are not far to seek. They are four in number: (1) material conditions—food, housing and clothing; (2) moral consideration—training, discipline and all the effects of shrewd and persistent progaganda; (3) immediate advantages—practical and theoretical education, clubs, sports, Summer camps and "rest-houses"; (4) subsequent advantages—assistance given to settling ex-soldiers in land "Communes," or in industrial work, and other examples of the paternalistic attitude of military authorities to ex-soldiers.

To these might be added a fifth reason: the prestige of the army itself has greatly increased in the last two or three years. This was shown by the pre-eminence given to high military leaders on the presiding council of the recent All-Union Soviet Congress, and by the tumultuous applause that greeted the announcement that the army budget had been tripled in 1934, as compared with 1933 and would be further increased by 20 per cent this year.

One reason for the growth of prestige has been the imminence of war danger. Another is that the Red Army is in a fair way to become an example of ideal communism—that is to say, the abandonment of personal profit, the establishment of communal life, cleanliness and punctuality, unswerving loyalty and obedience, and above all conscious discipline and self-respect, which Russians so much need.

Instrument of Defense

A factor which the Bolsheviki lose no opportunity of stressing, and in this they are unquestionably sincere, is that the Red Army is an instrument not of aggression but of national defense. Stalin's phrase, "No thought of attacking others but to defend to the last each inch of Soviet soil," has become the army slogan. Indeed, this is true of all the vast amount of military training, both moral and physical, that is now being given to the population of the U.S.S.R. from early childhood. Always, the people are told, it is training for defense, to protect the "Socialist Fatherland" against its enemies.

The country has undoubtedly responded. Not only do recruits, who under the Czar were torn weeping from their homes, now go willingly to service with songs and banners, but everywhere children and youngsters, and adults too for that matter, join the rifle clubs and the Osaviakim and similar societies.

Incidentally, much has been said about women in the Red Army, but in actual fact there are very few. There are two or three women's battalions of what in the United States would be called the Signal Corps—telegraph, telephone and radio—and there are perhaps a dozen women fliers and may be three or four women officers; but that is all. The much mentioned "women's battalions" and so forth are purely volunteer organizations, outside the regular army machine.

Sideshow in Big Drama of Empire

By K. K. KAWAKAMI, in the "Osaka Mainichi"

DESPITE American newspapers' exaggerated reports on the Chahar incident, the State Department has been singularly reticent this time, so much so that many Americans, accustomed to its usual protests, formal or informal, whenever Japan moves a step on the Asian continent, have been somewhat surprised. These Americans do not know the real situation. The American government, knows, perhaps, that this incident is merely an insignificant part in the great drama of empire building now under way on the Asian continent.

The chief actors in this drama are Soviet Russia and Great Britain, with Japan staging a sideshow in Chahar. The real meaning of the Japanese-Manchuokuo thrust into Chahar can be understood only in the light of that great drama. The curious fact is that the sideshow gets more free advertising and draws larger crowds than the big show. After all, the Japanese must be a shrewder showman!

The scene in the drama is laid in Mongolia (1,367,600 square miles), Sinkiang (or Chinese Turkestan, 550,000 square miles), Tibet (165,000 square miles), all so-called dependencies of China, as well as a part of Yunnan, a province of China proper, with the Chinese provinces of Kansu and Szechuen in danger of being drawn into it. These regions are obscure and inaccessible, far away from the beaten track, and, what is more significant, purposefully closed to foreign observers by the powers interested. It is a drama which is not meant for showing until it is all over.

Meanwhile, the Japanese sideshow in Manchuria (460,600 square miles) is for the whole world to see and criticize. Newspaper men of all nationalities and creeds have reported about it: foreign consuls, who have no legal right to be there, remain comfortably at Dairen, Mukden, Harbin, Antung, and Newchwang; the Lytton commission and a British trade mission have reported on it; foreign goods of all national origins enter there in increasing quantities. And so there is no use in wasting words on the little show. Let us peep through the closed door at the big show.

First about Mongolia. In 1912, in the wake of the Chinese revolution of 1911 which spelt chaos and disintegration, Czarist Russia virtually detached Outer Mongolia from China and made it a Russian protectorate.

Mongol-Russian Pact

The Mongol-Russian agreement concluded then stated that "in accordance with the desire unanimously expressed by the Mongolians to maintain the national and historic constitution of their country, the Chinese troops and authorities were obliged to evacuate Mongolian territory, and the Khutukhtu (Living Buddha) was proclaimed ruler of the Mongolian people."

"The old relations between Mongolia and China," it continued, "thus came to an end, and the Imperial Russian Government shall assist Mongolia to maintain the autonomous regime which she has established, and to admit neither the presence of Chinese troops on her territory nor the colonization of her land by the Chinese."

Interpreting the above agreement and the protocol annexed thereto, a Chinese writer, Ken Shen-weigh, says :

" It is to be noted that throughout the agreement the term ' Mongolia ' and not ' Outer Mongolia ' was used. Thus Russia by one stroke of the pen sought to nullify the age-old relations between Mongolia and China and secured for herself all the rights and privileges that even China herself did not enjoy in the days of her overlordship.

" In other words, China, hitherto the acknowledged suzerain, could not settle the foreign relations of her ex-vassal, could not deal with her directly, could not own land, could not colonize, could not build railways and have mining concessions. On the other hand, Russian subjects could move, reside freely anywhere in Mongolia, engage in every kind of business, commercial, industrial, or otherwise ; Russian subjects could make contracts of every kind ; Russian subjects could export and import goods free of duties, taxes, or other dues ; Russian credit institutions could have branches in Mongolia and transact all kinds of businesses, Russians could have allotments on lease, acquire them as private property or for cultivation ; Russians could obtain concessions of any kind."

All this is necessary to remember, because the Bolshevist regime in Russia has adopted and strengthened the Czarist policy in Outer Mongolia. In 1921, the Soviet army had entered Outer Mongolia in pursuit of the remnants of the White army and had set up at Urga a people's revolutionary government.

Russians at Helm

Needless to say that this government was " run " by Russians, military and civil. Then the two governments signed a secret agreement which was understood to have included these provisions :

(1) Soviet Russia and the Revolutionary Mongol Government recognize each other as the only governments in the territory of Russia and Mongolia.
(2) Taxes on imports and exports will be fixed by a mixed commission.
(3) The Soviet government undertakes to establish in Mongolia, free of charge, postal and telegraphic communications and will supply the necessary materials for this purpose.
(4) The Mongol government recognizes the right of property on land within the territory of Mongolia and agrees to give the Russians the ground space necessary for buildings of diverse kinds and for railways built with Russian capital.

Soviet Russia, as a price for winning China's recognition in 1924; is said to have withdrawn her troops from Outer Mongolia, but only after native troops had been drilled according to red ideas and red methods.

Moreover, the key positions in the native army are still occupied by Russian officers, while Mongolian finances and trade are virtually under Russian control. No foreigners, except Russians, are admitted into Outer Mongolia. None raises the question of the open door—not even Mr. Stimson ! Sooner or later, Mongolia will become a member of the Soviet Union.

But Outer Mongolia, to Russia, is only a step in her march toward China through Inner Mongolia, of which Chahar is a part. Under the Czarist regime, this advance was made by force at arms ; the Soviet regime attempts it by subtler methods.

Next about Sinkiang or Chinese Turkestan. This furnishes Russia with a second route of march toward China. Eventually this promises to become the main route, because that through Outer and Inner Mongolia is exposed to Manchuokuo-Japanese interception, as witness the Chahar operations.

Sinkiang is a vast territory between Mongolia and Tibet. In the late summer of 1931, its Chinese governor Chin Shu-yen, nicknamed " the Murderous Governor " because of his massacres of native Mohammedans, invoked Russian aid in order to quell a rebellion. Russia had just completed the Turksib railway skirting the western boundary of Sinkiang for hundreds of miles, and was ready to enter upon a contest of political and economic supremacy in that new field. In response to Governor Chin's appeal, the Soviet government rushed to Tehwa three bombing planes with Russian pilots, many machine-guns and rifles, and a large quantity of ammunition.

Russia's price for giving this aid was a secret agreement by which the Murderous Governor pledged himself : (1) To allow Russians to export the products of Sinkiang to Russia without special permit and without paying export duty, (2) to give Russia the exclusive right to promote industrial, agricultural, electrical, and transportation enterprises for the economic development of Sinkiang, (3) to allow the Russians the freedom of travel in Sinkiang, and (4) to allow Russia to establish radio stations at Tehwa and Kashgar, and to open telegraph communication between Sinkiang and Russia.

The Murderous Governor, though backed with Soviet money and Soviet arms, was finally forced to flee to Russia as a result of a *coup d'etat* staged by his enemies. Last year he was arrested in Shanghai whither he had gone secretly from Russia, and confessed much of his nefarious dealings with the Soviet Union or its agents.

Lo Sent to Sinkiang

Meanwhile, the Chinese government sent to Sinkiang its Foreign Minister, Lo Wen-kan, to look into the Russian situation there. He found that the Murderous Governor was not the only man who was Russia's puppet, but that other Chinese generals also danced on the Russian string. According to information from Chinese sources, the trade and industry of Sinkiang are being monopolized by Russians, while communist propaganda is keeping pace with economic penetration. The Russians set up shops and factories in all the principal towns, and put the Chinese and natives out of business. Ninety per cent of Sinkiang's foreign trade has passed into Russian hands. In 1929, Sinkiang's trade with Soviet Russia amounted to 7,130,000 roubles. In 1931, the figures increased to 24,110,000 roubles and in 1932 to 28,000,000 roubles. But the real meaning of the Sovietization of Sinkiang is that it is but a stage in Russia's advance into Central China via Kansu and Szechuen.

The Russification of Sinkiang has been a matter of grave concern to Britain. Soon after the construction of the Turksib railway, that is, in June, 1931, Britain sent to Sinkiang an expedition from Simla, India. Disregarding Chinese protests, it explored the country for six months. At the same time, another expedition was organized in London on a much larger scale. It was equipped with airplanes and automobiles, and spent a year and a half exploring about 60 per cent of the territory. Observing that the Mohammedans, who constituted the majority of the population, hated the Chinese and were hostile toward the Russians, Britain adopted a policy of befriending and supporting them. Thus the provisional government of South Sinkiang was inaugurated in the city of Kashgar toward the end of 1933. It is generally presumed that Britain has obtained in South Sinkiang much the same privileges as were secured by Russia in North Sinkiang.

Interested in Tibet

And now about Tibet. Beginning with Colonel Younghusband's expedition in 1904, Britain has been deeply interested in Tibet. For 30 years, it has been Britain's policy to extend her influence into Tibet by ingratiating herself with the Dalai Lama. When, in 1926-7, the Chinese nationalists under the guidance of two Bolshevist leaders, Michael Borodin and General Blucher (alias Galen), embarked upon a virulent anti-British agitation in the south of China, Britain rendered substantial assistance to the Dalai Lama's anti-Chinese campaign, thus hoping, perhaps, to make up in Tibet for what she was about to lose in the Yangtze valley. In 1929, it was reported that tens of thousands of British and Indian soldiers had been sent to Tibet, and that native troops had been trained by British officers.

Britain has also advanced her interests on the Burmese-Chinese borderland. On December 19, 1933, a contingent of British soldiers entered a region called Panhung which China had always claimed as part of Yunnan province.

They constructed barracks, a radio station, and an airfield. The region, covering some 4,000 square miles, is said to be rich in gold and silver. British entrepreneurs, under the aegis of the military operations, are reported to have begun mining operations.

And thus the game of empire building goes merrily on, and a new map of Asia is in the making. Once more the theory of the white man's burden is in full bloom.

Peace or War in the Far East?

By Lieut-Colonel CECIL MALONE (Until recently M.P. for Northampton)

Lieut.-Colonel Cecil Malone has closely studied events in the Far East for many years. He has travelled widely in China, Japan and Manchuokuo and is the author of a well-known booklet entitled (New China.) For some time he was Director of the Chinese Information Bureau.

* * *

VERY vital decisions concerning the political position in the Far East will have to be made during 1935. This pamphlet is written because the writer is opposed to War and fears that the present trend of policy advocated by an influential section in all parties in England is fraught with grave dangers to the cause of Peace and is calculated moreover to have disastrous effects on British foreign trade.

It is being advocated in certain quarters that Great Britain and the United States of America should combine together to force Japan to "stand by Washington principles"; and that in other ways an Anglo-Saxon union in the Pacific should be used to cripple Japan's economic and military position.

It is very strange that those who are the strongest protagonists of the collective system and of the League of Nations in the West, when it comes to the Pacific, are urging the association of Great Britain with one non-member of the League—the United States—in order to destroy the military and economic power of another non-member of the League, namely, Japan.

Such a policy would appear to be the height of folly. It is absolutely and diametrically opposed to the spirit of the League of Nations; it is an extremely provocative policy on lines very similar to the pre-war "balances of power." It would lead to the unification of the so-called Yellow Races and consequently to the almost inevitable loss of Britain's trade in China, and its results would be felt as far as, if not further than, India.

On the surface (forgetting for the moment that a large percentage of U.S.A. is non-Anglo-Saxon) an Anglo-Saxon world alliance may sound very attractive. We are members of one family, say its protagonists. Is not, they say, the United States really only a Colony which has broken away?

When, however, we begin to think a little and to work out the details, it is not quite so attractive.

The suggestion of some sort of Anglo-American understanding has been put forward by many public men in and out of Parliament in recent months, and notably by General Smuts and Mr. Lloyd George.

General Smuts said, in discussing the Japanese position in connection with the Far Eastern situation:—

> "... the future policy and association of our great British Commonwealth lie more with the U.S.A. than with any other group in the world. If ever there comes a parting of the ways, if ever in the crises of the future we are called upon to make a choice, that, it seems to me, should be the company we should prefer to walk with and march with to the unknown future."

The thought of what that "unknown future" might mean must give us pause to-day.

General Smuts is too astute a statesman not fully to realize the dangers; and in his case he was probably uttering a warning or a threat rather than putting forward a policy which he really thinks ought to be pursued.

Mr. Lloyd George, in his speech at Bangor on January 17, 1935, said:—

> "Fruitful action, especially in the East, involves, as the first condition of success, a complete understanding with America. I would immediately take steps to reach common agreement with that great country, and then act together, in a combined endeavor to secure the pacification of the world." (*The Times*, January 18, 1935.)

Recently, speaking at Birmingham, he amplified his statement when he said:—

> "Events (in the East) ... are gradually approaching a point where the United States and Great Britain can no longer safely put off and procrastinate." (*Sunday Times*, January 27, 1935.)

It has not yet been explained by any of the advocates of Anglo-American co-operation exactly what benefits, military or economic, Great Britain is to get out of the bargain. What is, however, certain beyond any doubt is that an Anglo-Saxon alliance would strengthen the militarists and weaken the liberals, the more pacific elements in Japan.

Opinion, moreover, is not solid in the United States.

Mr. Frederick J. Libby, Executive Secretary of the National Council for the Prevention of War, in Washington, U.S.A., in a recent declaration regarding the Far Eastern situation and the possibility of carrying out an aggressive campaign against Japan, opposed this in the following statement:—

(1) "Our Navy is not big enough, and will not be big enough even if we build the billion-dollar Vinson fleet including the battleships, to stop Japan's expansion in Asia if she is so minded. Even the recovery of the Philippines from Japan, if she should seize them to-night, would require a navy more than twice the size of her navy. The theory that we can 'curb' Japan by threat of war lacks realism. It is doubtful if the American people, unless war with Japan were actually declared, would make the sacrifices necessary to build a navy adequate for such a war.

(2) "A war with Japan, if fought in Asia in behalf of our economic interests in China—and that would undoubtedly be the cause of a war if war is permitted to come—would be a war of aggression in the true sense of the word, however camouflaged the issue might be. Such a war would be a betrayal of our ideals and a betrayal of humanity, which is trying to get away from wars of aggression.

(3) "In comparison with the appalling cost of a war with Japan, our economic interests in China are insignificant. An official estimate of the financial burden of such a war is understood to be forty billion dollars. Set that over against the value to the American nation of our trade with China, present and prospective, and the balance sheet will be overwhelmingly against that war. Our economic structure could not bear the burden of such a war and would collapse under it, leaving us with a depression that no planning could avert and that would be blacker than anything the world has ever known.

(4) "The conquest of Japan might conceivably be achieved in what is commonly estimated as a five-year war; but at what a cost. No one can estimate how many millions of our boys would have to lay down their lives on the soil of Asia and on the sea. Our 'victory' would be an even greater defeat than that which has followed the World War."

A great deal is also said regarding the attitude of the British Dominions, especially of Canada. This has been very much distorted and is largely American propaganda. Further, this propaganda completely ignores the strong feeling in Australia, which is in favor of an agreement with Japan and the recognition of Manchuokuo. Mr. F. M. Cutlack, correspondent of the Australian Press Association attached to the Australian Government's Eastern Mission in 1934, in his recently issued book says:—

> "We in Australia cannot contemplate the future with confidence if Japan's relations with the British Empire and the United States are to become embittered over this Manchurian issue. ... What right have we and the United States to oppose Japanese expansion, driven as it is by irresistible forces at home towards the nearest and natural outlet—a no-man's land and a quarter where Japanese overseas activity does us, and Britain too, the least possible, if any, real harm at all?"

An Anglo-American bargain would certainly bring about a union of the yellow races—China and Japan—against the white

races, with fatal results to Great Britain in China and elsewhere. Already there have been indications of a closer *rapprochement* between Japan and China, although China does not necessarily mean Nanking.

The future of the Pacific revolves round the regeneration of China and the advance which the 460,000,000 souls in China are likely to make during the next decade towards a standard of life approaching that of Western civilization. (Whether a Western civilization which produced the World War and the terrible years which followed is such a wonderful ideal for which to strive is a question which could be argued, but is outside the scope of this memorandum.)

Some people are inclined to imagine that a few officials from Geneva can go to China and organize her. Those who so think have never understood the vastness of China, the extent of the globe which it covers, the proportion of the world's population which it comprises, without, for the present, being able to provide for them anything more than the very poorest subsistence, and—what at the outset strikes the European traveller, perhaps, most—its lack of communications.

Japan has jumped generations in the last half-century or so since Prince Ito's Mission to Europe in 1870.

In so far as external help can expedite a rapid advance in China, that help is bound to come largely from Japan, with her experience gleaned from her own development during the past fifty years. With trade connections extending all over China—far in excess of those of any other country and probably equal to those of all foreign countries combined—with her considerable Japanese population actually living and working in China to-day, Japan is bound to have the greatest influence on China's development.

To say this is not to be in the slightest degree hostile to China. It is merely to face facts. The conscience of the modern world must assuredly safeguard China from foreign exploitation, but we cannot conceal from ourselves the fact that the economic potentialities of the Chinese market are the real key to the struggle of European and American capitalism for control of the Pacific. But the possibilities of trade, if China develops, are so great that there is surely room for all; and should not the results of the Great War convince us that nothing is to be gained by a sanguinary struggle and certainly the progress of China and the prosperity of her people will not thereby be furthered.

It is best for Great Britain and the United States to be friendly with Japan.

Whatever defects there may be in the foreign policy of the present British Government, Sir John Simon deserves the thanks of all peace-loving people for not allowing this country to be dragged into a war against Japan as so many well-meaning persons apparently desired.

Organizations and individuals who urged that the League of Nations should enforce sanctions against Japan to compel her to evacuate Manchuokuo seem to have failed to appreciate that the implications of "sanctions" have never been properly worked out, the League having no "planning staff." The organization of a small military police force for the Saar when the whole of Europe was at one as to its desirability and the two Powers principally concerned had already come to an agreement on this matter, is quite a different problem from the world organization of a punitive naval force to deal with a first-class Naval Power.

To enforce "economic sanctions" against Japan would have involved naval operations on a large scale in the Pacific and this would have meant that the burden would have fallen on the British Navy. For Switzerland, Paraguay, Bolivia and other member-nations of the League, who would doubtless have voted for sanctions, could have sent no battleships and the United States would certainly have kept out of active participation as long as possible, only too glad to see England pull the chestnuts out of the Pacific fire for her.

Throughout there has been a great deal of misconception about Japan's actions in China and the Pacific, especially in regard to Manchuokuo. The position has never really been fully and fairly explained to the English people. Even the Lytton Commission took up a somewhat unrealistic attitude.

In considering this and all other Far Eastern questions, it is essential to realize that the Government at Nanking is not the Government of China. It is true that General Chiang Kai-shek has to some extent stabilized his position within the last seven years. But it is far too early to judge whether his Government can ever develop and extend its authority over a wider area than the five provinces around Nanking. Great tracts of the vast sub-continent of China are virtually independent of the Chinese Government recognized by the Western Powers and this is a fact that must be faced. Even Canton is only nominally loyal—Cantonese antagonism being alleged to ebb and flow in conformity with certain financial transactions; and Sinkiang, Szechuen and many central provinces are completely detached. There is also that nebulous area known as Soviet China in which countries other than the U.S.S.R. are undoubtedly very much interested.

As for Manchuokuo, in *New China* (published in 1926) the writer emphasized very clearly that even then Manchuria, as it was then called, was virtually a Japanese Colony:—

> "Manchuria is an extremely prosperous territory. It is practically a Japanese colony, but it is more an investing ground for money than a field for emigration, as Japanese labor cannot compete with the lower standard of life of the Chinese worker. Japan owns the vital line of communication—the South Manchuria Railway. She owns also the enormous port of Dairen, the Liverpool of Manchuria. By these means she controls practically the whole trade of Manchuria. She has also established banks, hotels, stores, tramways, and so on. The yen is, in effect, the prevailing currency in Manchuria, and is to be found more often than local notes, roubles or dollars" (*New China*, page 3.)

At that time, in 1926, Manchuria was controlled by Chang Tso-lin. He was an ex-bandit. He was very cruel and his troops followed his example. He had a very bad reputation morally, especially in regard to women, opium and gambling. The writer recalls Chinese saying that they looked upon him as one of the worst enemies of the Chinese people.

It was Chang Tso-lin who was really responsible for cutting off Manchuokuo from China. He established himself in a pseudo-independence in which the country went from bad to worse. Anyone who recalls the worthless feng piao notes printed in their millions at Mukden will remember to what a condition Manchuria had fallen. Under this so-called Chinese War Lord, Manchuria was in no sense loyal to the Nationalist Movement or subject to any National Government. The writer was actually in Peking when his son, Chang Hsueh-liang, drove out the Nationalist forces in 1926; and when seen at his headquarters, he did not appear to be greatly distressed that his soldiers were looting the city, driving the men out of their little shops, looting them dry and molesting the women-folk. In that chaos and bad government under which the poor Chinese people suffered, Japanese influence in Manchuria was the only alternative ready to hand.

The real meaning of the action taken by the Japanese in 1931 is that they have regularized the position before existing and, according to all accounts, vastly improved conditions in those parts, compared with the reign of the independent Changs.

Many parts of China, much greater in area than Manchuokuo are equally independent of the so-called National Government at Nanking, and are also, some to a greater and some to a lesser degree, under various foreign influences.

There is Mongolia. It is strange how little is said about Mongolia. Mongolia is an independent State under strong Soviet influence. If Pu Yi is a puppet of Japan, so is the Mongolian Government at Urga a puppet of Moscow; and yet there are no protests and no trade boycotts against the U.S.S.R. who just walked in and took possession. Mongolia appears to be called the Mongolian People's Republic; and a further indication of its connection with U.S.S.R. was the appointment of Kalinen, Tchicherin and other Soviet statesmen as honorary Presidents of the first Mongolian Constitutional Assembly.

Mongolia may not have industrial wealth comparable with that of Manchuokuo, but it is strategically just as important. For 1,000 miles it flanks U.S.S.R. In area it is nearly as large as Europe without Scandinavia (See also *Memorandum on Outer Mongolia*, Document No. 21, July 3, 1932, submitted by Mr. Wellington Koo to the Lytton Commission and *The Mongols of Manchuria* by Owen Lattimore.)

When, therefore, we are talking about the Far East and the action of certain Powers, we must not forget Mongolia. Sinkiang, Tibet, Szechuen are almost equally independent of Nanking. Really the mistaken idea held by persons in Europe who have not

had the opportunity of visiting China that this great sub-continent of China is an entity ought to be dispelled.

To sum up, peace in the Far East can only be endangered by an exclusive Anglo-American alliance directed against Japan. Friendship with Japan is also needed. For that a better understanding of Japan, her problems and her attitude, is necessary.

The best way to a lasting peace in the Far East is by frank discussion between England, the United States and Japan. As Mr. Hirota, Japanese Foreign Minister, said in the Diet in Tokyo on January 22, 1935 :—

> "I cannot think of any part of the globe where an adjustment of interest between us might be considered in any way unattainable. It is needless to say that good understanding and co-operation between Japan and Great Britain constitutes a really important contribution to the peace of the world."

The Japanese have undoubtedly failed in the past in their approach to Europe. Japan regards herself as the leader in the Far East and as having a Mission. She should make known to the West her position, her problems and her intentions and seek a better understanding with the nations of the West.

Peace in the Far East, as has been said, depends largely on the solution of the problem of China, whose divisions and weakness keep her vast population in such extremes of misery and poverty, and are a constant source of temptation to the Great Powers.

The rehabilitation of China, the raising of the standard of living of her people, present a tremendous problem and cannot be achieved without external assistance. This must come mainly from Japan, though the experience of Great Britain in the industrial field can be of special help to her toiling masses. Nothing but evil can come from a conflict between Anglo-Saxondom (England and the United States) on the one hand and Japan on the other, for dominion in the Pacific by the further dismembering of the prostrate body of great China.

The Powers, and particularly Japan, should honestly assist China to reorganize and rehabilitate herself. An increasingly prosperous China, besides being so greatly to be desired for the betterment of the lot of the Chinese people, would provide an immense market for goods of all kinds ; but the field is so vast that there is room for all, and with wisdom there is surely no need for conflict between the nations.

I conclude that the immediate needs are the following :—

(1) A frank exchange of views between China, Japan, the United States and Great Britain.

(2) It should be realized that security in the Far East can only be achieved by the recognition and the reconciliation of the rights and interests of China, Japan, Great Britain and the United States.

(3) Japan should do her utmost to make known her case and her intentions to the world. She should draw up and put before the world a plan to co-operate, by peacefu. methods, in the reconstruction and rehabilitation of Chinal

(4) The policy of an exclusive Anglo-American Alliance directed against Japan should be abandoned as fatal to the cause of Peace and to the future economic interests of Great Britain and the British Commonwealth of Nations.

Better Days Are Coming

By B. C. FORBES, Editor and Publisher of "Forbes Magazine"

(The following short article perhaps may be taken as a sign of the times, for it seems that reactions in finance and commerce, like human migrations, move from east to west, and that conditions existing in America to-day swiftly are reflected in the trend of events in the Orient. The article, written by a recognized authority, is presented here merely as the echo of an optimistic note that comes out of the United States at a most timely season for American ears in the Far East and particularly in Shanghai. It appeared originally in "Liberty" and in condensed form here is reprinted from "The Readers' Digest.")

* * *

Not since the Civil War has America been so ripe and ready for a business boom.

Never before have so many individuals and families gone so long without things needed or desired. Never before has the equipment in American factories been so in need of renovation or replacement. Never before have homes throughout the land needed so much modernization and improvement. Never before have so many new homes been keenly wanted. Never before have so many farm buildings needed repainting and repairing. Never before have so many farms needed new implements, machinery, tools. Never before have so many families been anxious to purchase up-to-date automobiles to replace the cars of ancient vintage that clutter up our highways. Never before have so many housewives been eager for refrigerators, washing machines, radios, vacuum cleaners, modern ranges and cooking utensils.

Then consider the demand for air-conditioning, which promises to rival in its growth and employment-giving even the automotive industry. And before long television may sweep the country, affording new employment to vast numbers.

It is one thing to need these things, to want them ; but unless we can obtain the wherewithal to buy them, what's the use ? Happily, Americans do have the wherewithal to gratify enough of their desires to bring about a boom in business and in employment.

"Oh, yeah !" you may reply. "Don't you know that there are more families living on public relief to-day than at any time in the nation's history ?"

True. But these facts and figures are also true :

The total savings deposits of the people of this country have been increasing at the rate of more than $2,000,000 every day for many months. Despite the drain of five painfully lean years, our savings deposits amount to $22,000,000,000, a reduction of only 21 per cent from the peak reached during the wild 1928-29 boom. So colossal are the unprecedented excess bank reserves that more than $28,000,000,000 of new credit could be granted without resorting to currency inflation.

Never before was America so ideally prepared to finance business and employment expansion. Not only so, but a veritable Niagara of gold has been deluging this country from other parts of the world. In ten recent weeks fully $350,000,000 of foreign gold poured into America.

Our banking laws and regulations are such that each $100 of gold can theoretically be made the basis for granting $1,000 of credit. This means that recent importations of gold alone are sufficient to finance almost the entire four billion dollars Congress recently allocated to President Roosevelt for work-giving purposes.

So clogged up with money is America to-day that funds are being rented out in Wall Street at interest rates so low as to be unbelievable among those not familiar with the facts. Never before did lendable money go a-begging at such easy terms.

Thus every material and financial ingredient for greater prosperity than ever is now assuredly at hand. All that is lacking is confidence—confidence among industrial leaders, among investors, among business men, among employers—that Washington won't upset things, but will instead co-operate wholeheartedly in encouraging the return of enterprise, of investing, of spending, of prosperity—including a return of a much greater volume of employment. I am hopeful that it has already become clear to Washington that genuine prosperity cannot be achieved by politicians alone, but that business, industry, employers, investors, consumers must all take part.

President Roosevelt intimated six months ago that he had awakened to a realization that in order to expedite revival of trade the government must seek and win the co-operation of the fillers of pay envelopes. It had become evident that the administration, single-handedly, could not create prosperity no matter how much money it might collect from tax-payers and spend on "made" work, in doles, or for other purposes. President Roosevelt began calling into council men of mature business experience. Hopefulness

(Continued on page 215)

China's Position in the World of Minerals*

By CHUNG YU WANG, Commissioner of Hankow Bureau of Inspection and Testing of Commercial Commodities; President of the Association

(The following paper was given as the Presidential Address on April 6, 1935, at the annual meeting of the Association of Chinese and American Engineers at Peiping.)

* * *

THOMAS T. READ, Professor of Mining Engineering at Columbia University, has pointedly remarked that "the civilization of the twentieth century may fairly be characterized as a mineral civilization." Indeed this mineral civilization has only come about through the intensive development during recent times of what has been so aptly named by Probert the "third kingdom," in distinction to the animal and vegetable kingdoms. We have come to realize that the fabric of modern life is intimately woven with the thread of mineral substances and that human progress is insistently predicated upon the control or possession of the mineral deposits, scattered so indiscriminately, as it were, by Nature which knows no national boundaries, on the surface of this globe. Thus no country is self-sustaining in minerals, so needful nowadays for the upbuilding of the industrial structure of a country, although some countries are more favored by Nature than others in the possession of the essential minerals. So it is quite obvious that China cannot form an exception to Nature's favors in her gift of minerals to different nations. In order that you may the better understand the present position of China as to her distribution and production of minerals relative to those of other countries, I want to digress here to give you a brief historical sketch of the subject under discussion.

When Europe and America were just perhaps emerging from the stone age, China had already attained a civilization comparable to the Egyptian civilization of that day. You may remember that nearly contemporaneously, between 2000 and 3000 B.C. gold and copper were known to both the Chinese and the Egyptians. Long before the Han dynasty, the so-called Golden Age of Chinese history, 206 B.C. to 25 A.D., the famous silver mines of Laurium in Greece had already been opened up, and for a long time had been the backbone, as it were, of Grecian supremacy and prosperity. It has been estimated by Cordella that in the three centuries from 600 to 300 B.C. the mines of Laurium yielded 2,100,000 tons of argentiferous lead, worth about G$800,000,000, equivalent to about $2,200,000,000 silver.

This immense amount of wealth, be it noted parenthetically, would be sufficient to refund all China's present loans which are due to foreign countries. Still, mining in China during the so-called Golden Age of Chinese history did not flourish much, although, according to Collins, "the people of Fergana acquired the art, new to them, of casting iron, tools and utensils, from the Chinese" who had come then into contact with the peoples of the West, due to Chinese conquest and trade expansion during that period into that part of the world. Nowadays we deplore the drain of silver from China to the occidental countries, while forgetting that during the first few centuries of the Christian era the movement of silver was contrariwise. In fact, in "Man and Metals," Rickand says, "The drain of precious metal from Europe to India and China has perturbed economists for nearly two thousand years .... Pliny complained that India drew from the Roman Empire not less than 550,000,000 sesterces per annum. And in those days the purchasing power of money, owing to its scarcity, was at least twenty times what it is to-day. The gold and silver went to the Orient in exchange for its decorative products, its silken fabrics, its jewelry, its jade and ivory, and its spices." From this you may see that during those early centuries, while China was devoting her energy exclusively to the pursuits of literature and other æsthetic arts, to the neglect of mining, the countries of Europe were steadily forging ahead in the development of the mining industry to such an extent that their accumulation of wealth in the form of gold and silver could allow them to replenish themselves for the drain of wealth to the East as well as to barter for the luxuries of the East. However, during the Tang dynasty, 618 to 907 A.D., mining and metallurgy received some sort of encouragement, due to the impact of the practice of alchemy which arose as an outcome of the spread of Taoism.

As to the state of mining during the Sung dynasty, we are fortunate to have come across a record for the output of the mines in 1078 A.D., which thus serves as an indication of the condition of mining during that period. It is as follows (after Collins):

Gold	10,710 *liang*	(14,280 oz.)	
Silver	215,385 ,,	(287,180 oz.)	
Copper	14,605,959 catties	(8,693 tons	292 lb.)
Iron	5,501,097 ,,	(3,274 tons	1,033 lb.)
Lead	9,197,335 ,,	(5,474 tons	1,353 lb.)
Tin	2,321,898 ,,	(1,382 tons	184 lb.)
Mercury	4,456 ,,	(2 tons	1,461 lb.)
Cinnabar	3,640 ,,	(2 tons	373 lb.)

From that time down to recent decades, while the policy of the rulers in Europe with regard to mining has been a steady one of encouragement, in China, the rulers invariably have pursued a policy of vacillation, according to their whims and fancies. Perhaps we may attribute the causes for the retardation of Chinese mining to the mental attitude and philosophy of the Chinese race. However, there are causes other than these to account for the backwardness of the mining industry in China of which I shall have something to say a little later.

In order that you may be impressed with the immensity of the mining industry in the world as a whole during recent years, I wish to give you a few examples indicating such immensity.

Roughly speaking the total production of all the mines in the world during the last thirty years may be approximately equated with the total production from the beginning of historical times down to thirty years ago. The quantity of iron ore produced with the employ of 175 miners in a mine in Minnesota in two weeks' time is equivalent to that of the Pyramids in Egypt which required the labor of one million men for twenty years. The present-day annual world-production of copper is equal to the total production from the beginning of historical times down to one hundred years ago. According to Leith, the total capital of the mining industries of the world amounted to G$100,000,000,000 in 1922, and the tonnage of the mineral production of that year has been estimated at 2,000,000,000 tons, worth about G$9,000,000,000. Again, according to Turner the value of the mineral production of the entire world in 1929 was about G$14,500,000,000, as contrasted with G$1,150,000,000, the mineral production during 1886, that is, the value of 1929 was ten times that of 1886.

Following Dr. W. H. Wong, Director of the Chinese Geological Survey, China can be roughly divided into three metallogenetic provinces: North China, the Yangtze Valley, and South China. In North China the old pre-Cambrian schists and gneisses are represented by the abundance of quartz mines in which sporadic occurrences of copper, lead, zinc, gold and silver are sometimes found in subordinate quantities; along the Yangtze Valley and Central China, extending eastward as far as Shantung, are found here and there occurrences of intrusions of dioritic rocks, in which occur the famous contact deposits of iron ore, besides which minor quantities of copper, lead and zinc are also found; in South China the igneous intrusions are of granitoid type in which, or in the vicinity of which, occur in certain regions immense deposits of antimony, tungsten, tin and mercury. Broadly speaking, most of the famous coal mines are now situated in regions north of the Yangtze River, in which occur also the sedimentary deposits of iron in contradistinction to the contact deposits of iron along the Yangtze Valley.

The notion that the Far East, China included, is a great treasure house of minerals, is now exploded. Of the many prominent mining engineers, such as H. F. Bain, G. E. Brown, Pope Yeatman, Herbert Hoover, and J. W. Finch, who have had varied experiences in China and who have helped to discount the too rosy views of the immense mineral deposits of China, I wish just to mention Foster Bain, an authority on the mineral resources of the Far

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East, who sustains the view which I have long held, and mintained in my paper before this Association some fourteen years ago, that China is indeed very poor in mineral wealth in a modern sense. Bain says, "The current notion that China is a country of unlimited mineral wealth is hardly in accord with the facts. Many deposits occur and there is a wide variety of minerals present but in a majority of instances the ore bodies are small and of such type as not to lend themselves well to modern methods of mining."

Taking the Far East as a unit, the density of its population is 140 per sq. mi., while that of the United States is 44. It has been estimated by Torgasheff that the value of the annual production per man per sq. mi. of the Far East is G$0.00003 while that of the United States is G$0.00141, that is, the value of the former is only 2.2 per cent of the latter. It is interesting and instructive to make a comparison between the yearly productions of a few essential minerals in China and those in the United States, during recent years.

	United States		*China*
	$\frac{1}{20}$ of the earth's surface		$\frac{1}{14}$ of the earth's surface
	6% of the world population		30 % of the world population
Coal	35% of the world production		2.3 % of the world production
Copper	47%	,,	0.03% ,,
Lead	36%	,,	0.16% ,,
Zinc	42%	,,	0.35% ,,

The implication of the above figures is quite obvious and needs no amplification.

Taking a broad view of the production of minerals in the Far East, which includes countries extending from Siberia to Burma, we arrive at the following figures, based on percentages of the world's totals for 1924 (after Bain) :

Tungsten	94%	China furnished	63%
Antimony	80%	,, ,,	80%
Tin	66%	,, ,,	6%
Lead	6%		
Zinc	6%		
Copper	5%	Japan furnished	5%
Coal	5%	China ,,	2.3%
Steel	2%	Japan ,,	2%

Thus it may be seen that China, as a mineral producer, is rather rich in a few of the minor minerals, but very poor in the essential minerals.

Taking 1927 as a normal year after the Great War, the value of the production of minerals in China in that year amounted to $68,720,000 and that of non-metallics (coal included) amounted to $230,338,000, totalling $299,058,000, these figures being based on the estimate made by the Chinese Geological Survey. On the other hand, Torgasheff in his book, "The Mineral Industry of the Far East," gives the estimate for the value of the production of both metallic and non-metallic minerals during 1925, as G$394,166,000, which, on the basis of G$1 = $2 silver, is equivalent to $788,332,000. The discrepancy between the above estimates lies in the fact that, in the estimate as given by Torgasheff, the common non-metallic minerals such as precious stones, kaolin, raw clay, limestone, stone and gravel, etc., which are omitted in the estimates of the Chinese Geological Survey, are incorporated therein. In fact, the amount of $65,340,000 as estimated by Torgasheff for the metallic minerals, is not far off from the Survey's estimate for identical minerals. Again, Torgasheff's estimate of $788,332,000 can be apportioned thus :

Metallic	*Fuel*	*Non-metallic*
$65,340,000	$234,952,000	$488,040,000
8.2%	29.7%	62.1%

The values of the world's production between metallic, fuel and non-metallic can be expressed in percentages thus :—

Metallic	*Fuel*	*Non-metallic*
30%	48.0%	21.6%

In other words we say that in China the value of the non-metallic products is about 7.5 times that of the metallic products, whereas for the world as a whole, the former is merely three-fourths of the latter. To bring home to you the idea of the comparative backwardness of the Chinese mining industry, I should like to impress you with the following facts. The value of the mineral products of China is 2.3 per cent of that of the world and 6.6 per cent that of the United States. In China the annual per capita production amounts to about $1.70, while for the world it amounts to $18, for the Far East $2.70, and for America $100.

The relative importance of the minerals now produced in China is shown in the following table :—

	A. Minerals available in large quantities for export	B. Minerals adequate to meet domestic demands without appreciable excess or deficiency	C. Minerals inadequate to meet domestic demands; partially dependent on foreign sources	D. Minerals for which the country depends almost entirely on foreign sources
1. Metals and their ores	Antimony Pig Iron Manganese Tungsten Tin	Mercury	Copper Steel Lead Zinc	Aluminum Chromite
2. Non-metals	Coal Gypsum Magnesite	Fluorspar Talc Soapstone Asbestos Graphite Mica	Pyrites Sulphur	Petroleum Phosphate Potash Nitrates

In a way, the industrial condition of a country may sometimes be gauged by its per capita consumption of metals. The following figures are given to show the relative positions of China, the United States and Japan with respect to the annual per capita consumption of copper, lead and zinc, from 1922 to 1924 :

Copper	China	0.03 lb.	1 part
	U.S.A.	12.19 ,,	400 ,,
	Japan	3.62 ,,	12 ,,
Lead	China	0.06 lb.	1 part
	U.S.A.	10.55 ,,	180 ,,
	Japan	1.10 ,,	17 ,,
Zinc	China	0.06 lb.	1 part
	U.S.A.	7.99 ,,	130 ,,
	Japan	1.56 ,,	26 ,,

At present the minerals that are available in large quantities for export are antimony, tungsten, manganese, and tin, not counting iron ore and coal, which will be discussed later. Besides these I may mention the alunite deposits in Chekiang and Fukien and the bauxite shale deposits in Shantung, both of which, I deem, possess an immense possibility for future exploitation and development.

During the Great War China contributed 60 per cent of the world's production of antimony, which percentage during recent years has increased to between 70 and 80 per cent. The deposits of antimony at Hsi Kwang Shan, Hunan, really form a veritable storehouse of antimony for the future market of the world. At the present rate of production, say 15,000 tons of metallic content yearly, and assuming that the estimate of ore reserves made by Tegengren be correct, these deposits will last 100 years. However, if the total ore reserves of the antimony deposits in Hunan, Kwangsi, Yunnan and Kwangtung, are taken together, they will perhaps last about 200 years at the present rate of production. For a quarter of a century, China has assumed the position of a virtual monopoly for the supply of antimony in the world market, which position is now, however, being challenged from different quarters. First, the establishment of the Texas Mining and Smelting Co. at Laredo, Texas in 1931, now protected behind tariff walls, has gradually become a great factor in undermining the price of Chinese antimony in America. It must be remembered that, hitherto, China has been supplying 65 to 85 per cent of America's consumption of antimony, but now the Texas Mining and Smelting Co. is apparently pursuing a policy towards the gradual elimination of Chinese antimony from the American market. Secondly, and this is rather serious to the Chinese antimony industry, many laboratories in America and Europe are looking for some new lead alloys for the purpose of supplanting the use of antimonial lead for storage batteries as well as for bearing purposes. In fact, a new bearing metal, called Bahnmetall, a lead-calcium-sodium alloy containing some hundredths of 1 per cent lithium, possessing better anti-friction and wear-resisting properties than the usual antimonial lead alloys, is used in railroad cars in Germany to the amount of several million pounds per annum. Allow me to repeat here what I wrote about substitutes for antimony in my address, "The Mineral Resources of China," which was delivered before this Association fourteen years ago :

"I am quite persuaded to the view that antimony, as a metal, has lost some of its former importance, both as a war and as an industrial metal, and that its demand in the future will decrease instead of increase. You may have heard of the researches carried out during the War by the Allied Powers as well as by Germany, to find a substitute for antimony. To my mind, such substitutes have been discovered, but it remains to be seen how far such substitutes will take the place of antimony, which has hitherto been used to a great extent for the hardening of lead and other alloys. According to Professor Touceda, the leadcadmium alloy is far superior to leadantimony, in possessing more ductility, hardness and a finer grained structure. The new 'Ulco' alloy, composed of lead and a small amount of calcium and barium, was used during the War as a substitute for antimonial lead in the manufacture of shrapnel and has been claimed to be as good as other bearing metals on account of its high melting point, excellent structure and low coefficient of friction. Mention may be made of the German substitutes, such as the alloys of arsenic, tin and lead and of arsenic and cadmium, patented by Zimmer, the alloy of lead, magnesium and aluminum, patented by Hanemann and Stockmeyer."

I view with great concern the present rise in the price of antimony, which is due in part to the artificial manipulation of the Hunan Antimony Syndicate as well as to the urgent demand in the market. The Hunan Syndicate may be likened to a two-edged sword, capable of cutting both ways. The Syndicate has really boosted the price up but, while doing so, it has actually become an unconscious factor in the eventual opening up of some foreign antimony mines, which otherwise would have remained dormant, and in the urging of users to find new substitutes for antimony. I do hope that, before it is too late, those who are responsible for the creation of this Syndicate, will eventually be led to take an enlightened view of and a realistic approach to the situation.

Next to antimony, wolfram occupies a position of great importance in the mining industry of China. Its production has amounted in recent years to between 60 and 70 per cent of the world production. You may have heard of the agreement for the sale of wolfram ore made by the Ministry of Industries with Arnhold and Co. and of its subsequent unfortunate cancellation due to pressure brought about by the Canton government. Tungsten exported as an ore, is quite different from antimony exported as a metal. To my mind, a State Sale Monopoly of tungsten ore is both feasible and suitable, as its use is widespread; the likelihood of a substitute being found is flimsy and its production to supply the world market is mainly confined to China and Burma. In China, the main deposits of tungsten are located in the southern part of Kiangsi, bordering the Kwangtung boundary. It has been found that "the people of the tungsten-bearing region (Kiangsi) live, so close to want that tungsten is produced at practically any price that is paid for it." Thus, it would appear that just merely to prevent indiscriminate mining and waste and for the sake of the conservation of the rich deposits and the prevention of early depletion as well as for the improvement of the mining methods, or rather lack of methods, I favor Government participation in this industry.

Manganese, as an ore, is absolutely indispensable to the iron and steel industry. Although the iron and steel industry of China is still in its infancy, yet, in view of its future expansion and development, an adequate supply of this ore must be assured. Deposits of manganese are found scattered in varying quantites in Hunan, Kiangsi, Kwangtung and Kwangsi, from which, in the years from 1929 to 1931 inclusive, the total quantities exported to Japan amounted to 111,514 tons. The ore reserves of the known deposits in these provinces, according to Y. F. Chen (privately communicated) amount to about 1,600,000 tons, which would last only 50 years, for an assumed daily output of say 1,200,000 tons of pig iron. Consequently, I advocate government intervention to restrict the export of this important mineral in order that it may be conserved for future utilization in the iron and steel industry.

During recent years aluminum looms large as a substitute in the form of alloys for certain structures and uses. In fact, it has been pointed out that the next age will be an age of aluminum. At present, so far as I can see, the future hope of aluminum production in China lies in the exploration of the bauxite shale deposits in Shantung and alunite deposits in Chekiang and Fukien, of which the former, according to the estimate made by the Chinese Geological Survey, contain about 270,000,000 tons, one quarter of which is rich enough for development, and the latter, according to surveys made by the Academia Sinica, 500,000,000,000 tons. For the present I cannot say much about these immense deposits, except that they undoubtedly possess great possibilities awaiting the work of future technicians.

With regard to the coal and iron resources of China, allow me to quote in extenso from my paper, delivered before this Association last year:

"By noting the reserves of coal and iron of a country as well as its per capita consumption, we can arrive at a measure of the degree of industrialization of that country. China, indeed, does possess immense reserves of coal, but, for the present, they are mostly land-locked. On the other hand, China is deficient in iron ore when we consider the size of the country and its population. We need not worry about the future supply of coal in China, for at the present rate of production of say 40,000,000 tons (including of course the production of native pits) per year the coal fields of China can last us from 5,000 to 12,000 years, the former figure being based upon the estimate of reserves of Prof. Hsieh, the latter, that of Fuller and Clapp. Taking the energy production of the different countries into consideration Prof. Read has deduced some very illuminating figures; thus, for every person in the United States there are 36 mechanical slaves in his service, in Japan 2.2, in India 1.4 and in China only 1.2, which last figure is quite indicative of the low stage of industrialization attained hitherto in China.

"With regard to iron, China shows up very poorly. According to Kuhn, the iron ore reserves of China amount to about $\frac{1}{150}$ of the total reserves of the world. If we consume under normal conditions say 800,000 tons of iron and steel per annum, and if we produce all the tonnage ourselves—at normal times about 600,000 tons of steel products are imported into China per year—the ore reserves of China would last us from 260 to 550 years according to whether we base the estimate on only the rich ore or on both rich and poor together. We shall be the more impressed as to the low stage of our industrialization if we envisage it by taking the per capita consumption of iron and steel into consideration. Considering 1927 to be the normal year, we find that the annual per capita consumption is as follows:

China	4 lb.
America	1,030 ,,
Japan	70 ,,

In other words the per capita consumption of iron and steel per year in China is about $\frac{1}{257}$ of that of the United States and about $\frac{1}{91}$ of that of Japan. If the per capita consumption of China were equal to that of the United States, the depletion of her reserves would take place within a period of from seven months to a year and a half, and if it were the same as that of Japan, the period would lengthen to from nine to twenty years, according to whether we take rich ore or both the rich and poor ore together into consideration. Thus from the standpoint of mineral resources alone, especially of iron ore, we may assume that China, being so handicapped with the lack of an adequate supply of minerals, would not be able in the course of her industrialization, to wrest the supremacy of industrialization from the West."

For the consumption of coal in China according to its various uses the following tables are given, one according to the estimate made many years ago by me and the other according to that of Torgasheff:—

According to C. Y. Wang	*Metric tons*	*Per cent*
Household (interior)	9,990,000	33.3
Household	3,000,000	10.0
Electric light plants	3,000,000	10.0
Cotton mills	1,410,000	4.7
Other manufacturing plants	5,370,000	17.9
Railways	1,320,000	4.4
Steamers	1,200,000	4.0
Consumption at mines	2,400,000	8.0
Exports	2,310,000	7.7
	30,000,000	100.0

According to Torgasheff

Household (interior)	9,990,000
Household	3,000,000
Modern industry	15,000,000
Native industry	2,000,000
Railways (locomotives and other uses) .	3,000,000
Bunker coal	3,000,000
Consumption at mines	2,400,000
	38,390,000

With regard to the reserves of coal and iron in China as compared with other countries, H. F. Bain gives the following illuminating table :

	Area sq. mi.	*Population Millions*	*Population Density*	*Reserves in tons per capita Coal*	*Iron ore*
China	4,278,352	427,679	100	2,330	2
U.S.A.	3,743,529	112,000	30	34,274	670
Japan	149,793	55,963	373	150	1.5
Italy	119,733	38,901	324	5	0.2

I want now to say a few words about the future production of steel in China. You must have heard a great deal these last few years about the installation by the Government of a steel plant at Manon-shan with which I have been more or less connected from the beginning until now. After prolonged study and investigation, it is my candid opinion that if the capitalization of the steel plant should not be over $300 per annual ton of steel products, then a net profit of about 5 per cent may be reasonably expected, after 6 per cent for interest and 8 per cent for depreciation and repair have been deducted.

It has been said that the iron and steel industry is a prince and pauper industry, the truth of which can be judged from the following figures, giving the average profits of the industry in the U.S.A. in different years :—

1915-1918	24.1 %	
1926	7.48%	
1927	5.22%	These two years considered as normal years.
1928	6.55%	
1930	4.54%	
1931	0.40%	
1932	2.85%	(loss)

We must not take too rosy a view of the iron and steel industry now projected, for we must take into account the inevitable competition coming from the powerful and efficient concerns in Europe, Japan, India and Russia. China should take a leaf out from India in the matter of a protective tariff for the infant industry. The fact that India, even with her cheap coal and ore in close proximity to the works, did need and still needs a high tariff to protect her steel industry, is a fair warning to China, if she should neglect to take steps at the beginning to screen her new industry of iron and steel behind a tariff wall high enough for its requirement.

Now we come to the all important question of why ore deposits in China are so meagre and sparse. About ten years ago, in a paper entitled " The Relation of Tectonics to Ore Deposits " which I read before the Geological Society of China, I tried to set forth my view with regard to such a question. My theory, as embodied in that paper, came to the attention of J. E. Spurr, the well-known geologist, who in one of his editorials in the *Engineering and Mining Journal* had this to say :

" The views he presents are worthy of more than a passing mention, comprising, as they do, an explanation of the ' paucity of mineral deposits in China.' This theory is therefore not only of great scientific interest, but will be considered attentively by those who are interested or propose an interest in the exploration and development of China's mineral resources. . . . . Without attempting to pass judgment upon the criterion in Mr. Wang's paper, it is conservative to say that this theory is the result of clear and bold thinking, and well deserving of most thoughtful consideration."

The thesis of my paper, just referred to, is, in brief, this : according to Chamberlain, mountains can be divided into two classes, the " thick-shelled " mountains and the " thin-shelled " mountains. " These ideas of Chamberlain are pregnant with meaning when taken into consideration with ore deposition. We learn that the metallogenic minerals are stored way down deep in the baryphere. Hence, if we want to tap, so to say, this storehouse of ore minerals, we must resort to the application of a force that is far-reaching and profound. It is this vertical or radial force, as conditioned by isostatic adjustment, that causes the upwelling or surgence, to use a term coined by Spurr, of the magma in depth, bringing with it whatever ore minerals happen to exist at the time, along the lines of weakness of the crust, which are located principally between the margins of the continental plateau and the foredeep or trough of the oceanic basin. Conversely, the horizontal or tangential force that causes the development of thin-shelled mountains is not profound enough to reach into the deep region of the earth, and hence in mountain chains thus originated, no important ore deposits are expected to be found. We thus see that any discussion of the origin of ore deposits is involved in that of mountain formation. Indeed, both problems are one and the same."

Tentatively I maintain that in the development of the most of the mountain chains of China, the horizontal force has played the most important part and hence most of the mountains belong to the " thin-shelled " type. And therefore on the tectonic grounds thus outlined above, I am justified in concluding that there is little hope for the future discovery of any large ore deposits in China, save perhaps in the western part of Szechuen.

British Ropeways Designers Organize

An Association of important Companies who manufacture Ropeways, Cableways, Conveyors and Handling Plants has recently been formed, the objects being to secure orders for this class of engineering work for Great Britain.

In connection with this new enterprise attention is called to the advertisement appearing in this issue of The British Ropeway Engineers and Designers, British R.E.D.C.A.P., 11 Ironmonger Lane, London, E.C., England.

British engineers, though undoubtedly supreme in the design of Ropeways, etc., are often not consulted, due, in the main, to lack of information available for buyers in different parts of the world.

Therefore it has been decided by the Association to launch an advertising campaign from a Central Office in London to which enquiries can be addressed. The Central Office will distribute these enquiries to the firms best able to forward a proposition to suit the installation required.

The collective advertising scheme is intended :

(1) To secure more orders for Britain.
(2) To permit more advertising at no greater cost to the industry as a whole.
(3) To save expense and inconvenience to buyers in sending out more than one set of plans and particulars.

The firms forming the Association are in every other respect separate and competitive Companies.

Better Days Are Coming

(Continued from page 211)

arose. Men of affairs started to exercise a greater measure of courage and aggression.

Unfortunately, this promising forward movement suffered a jolt when President Roosevelt announced that he hoped to see the government establish all over the country public-utility experiments similar to the Tennessee Valley Authority, to compete with existing companies. Other uncertainties have since injected themselves, including Washington's decision to spend billions on construction and other projects to give work to unemployed. Business and industry are apprehensive lest such a vast program interfere with private enterprise and also pile up such a public debt that a balanced budget within the reasonably near future may be impossible and crushingly heavy taxes inescapable.

No mortal can foretell at this moment when the one missing ingredient—confidence—will be supplied. But this much can be said with emphatic certainty : Sooner or later America will regain confidence and will proceed to resume normal spending and normal living.

When this time comes, we shall reach heights of prosperity beyond anything enjoyed in 1928-29 or in any earlier period of our history.

New Turbo-Generators for Manchuria Are being Supplied by the A.E.G.

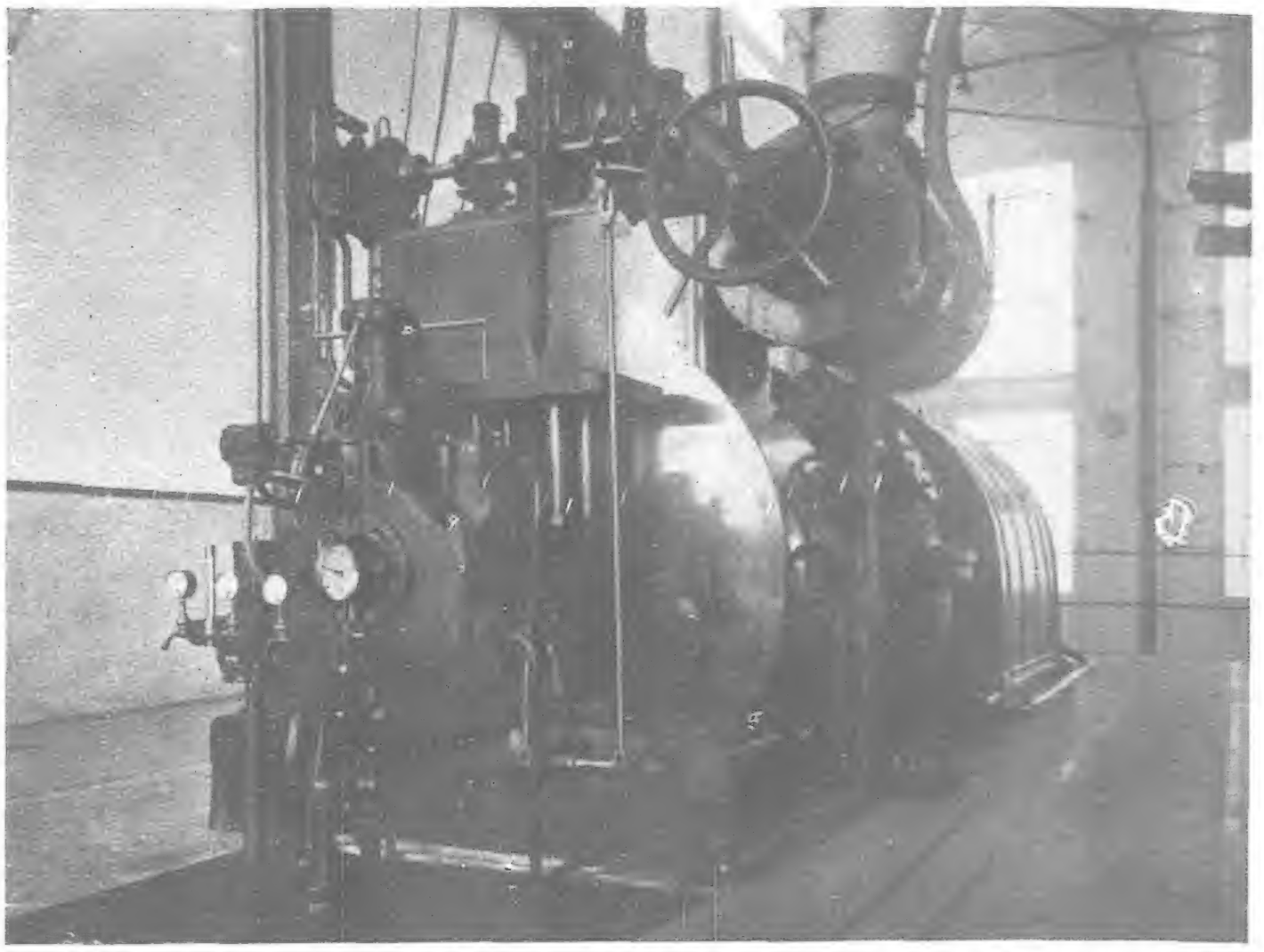


Fig. 1.—5,000 kw. AEG Turbo-Generator installed in power station of the Dah Sung Cotton Mill, Nantungchow

AMONG the orders received recently by the A.E.G. for turbo-sets, two for Manchuria deserve special mention.

One of them is a 12,500 kw., 3,000 r.p.m. condensing turbine-generator for carrying a load of 15,000 kw temporarily and designed for a steam pressure of 26 atmos. abs. (370 lb./sq. in.) at 385° C. (730° F.), 11,000-volts, 50-cycles, with a complete preheating and evaporating plant. It is destined for a large steelworks and will be simultaneously coupled via converters and transformers with the newly planned national supply system of Manchuria.

The second set is for a large chemical works and comprises a 4,000 kw., 3,000 r.p.m. extraction back-pressure turbine rated for 34 atmos. abs., 425° C. (470 lb./sq. in., 800° F.), 3,300-volts, 50-cycles and for a steam extraction of 28,000 kg/hr. (27½ tons/hr.) at 11.5 atmos. abs. (165 lb./sq. in.), and for delivering 27,000 kg/hr. (26½ tons/hr.) back-pressure steam at 5.5 atmos. abs. (78 lb./sq. in.). The A.E.G. is also supplying this works with two steam converting plants for dealing with an aggregate steam quantity of roughly 40,000 kg/hr. (39 tons/hr.).

The steam turbine has undergone many changes and great progress has been made in designing machines to suit in the best possible manner all economical and working condition of modern industrial and public power stations.

The turbine is a driving machine, the construction of which requires especially great experience in manufacture, thorough experience in operation and extensive scientific work for designing and testing.

In considering the present stand of modern steam turbine design one principle must retain the greatest importance: the demand for absolute reliability. It is indisputable that its importance is even increased, for power plants in China, due to the local condition, i.e., great distance of the installation site from the factories, lack of skilled labor and of special machines and equipments required for repairing, etc.

The losses from a close down can be very great, even if the expenses of the urgent repairs are not considered. Reliability is therefore not only primarily important from a technical point of view, but perhaps even more from an economic point of view, because an involuntary stoppage may easily mean the loss of many month's saving in fuel consumption.

For the steam turbine this means the trend to greatest simplicity in design, small number of stages, one or at most two casings, ample radial and axial clearances and strong design of all parts especially of the guide and rotor blades.

When comparing turbines of equal efficiency but different construction, the turbine showing greater simplicity in the above sense should be preferred. In this respect the impulse turbine with low percentage of reaction in the low pressure stages and disk type turbine runner is superior to all other turbine types.

This turbine can be adapted to the requirements of all capacities and steam pressure ranges.

In the high pressure part of this turbine the impulse system is used. For this system large clearances can be allowed between the stationary and rotating parts because no pressure difference exists between rotor blade inlet and outlet, and therefore no leakage losses arise in the rotor blades.

In the low pressure part a smaller or greater percentage of reaction will be employed dependent from the steam volume. The steam volume and therefore the blade length in the low pressure part being very high, the leakage losses arising in this part are low even for ample blade clearances. The impulse turbine with disk type runner wheels is therefore equally suitable for the high pressure and low pressure turbine part.

With the large clearances the impulse turbine is more reliable and will maintain its efficiency better. Moreover, this turbine runs up in short time, thus achieving the desire to cut down the frequently extensive starting periods experienced with reaction type turbines.

In this connection must be mentioned that the reaction principle which is employed by some manufacturers even for medium and high pressure parts need in these pressure ranges very small clearances in order to reduce the tip loss. Moreover, this turbine type requires a greater number of stages to obtain the same efficiency as with the impulse principle. The multi stage reaction turbines with their small clearances in the h.p. parts are therefore more liable to faults.

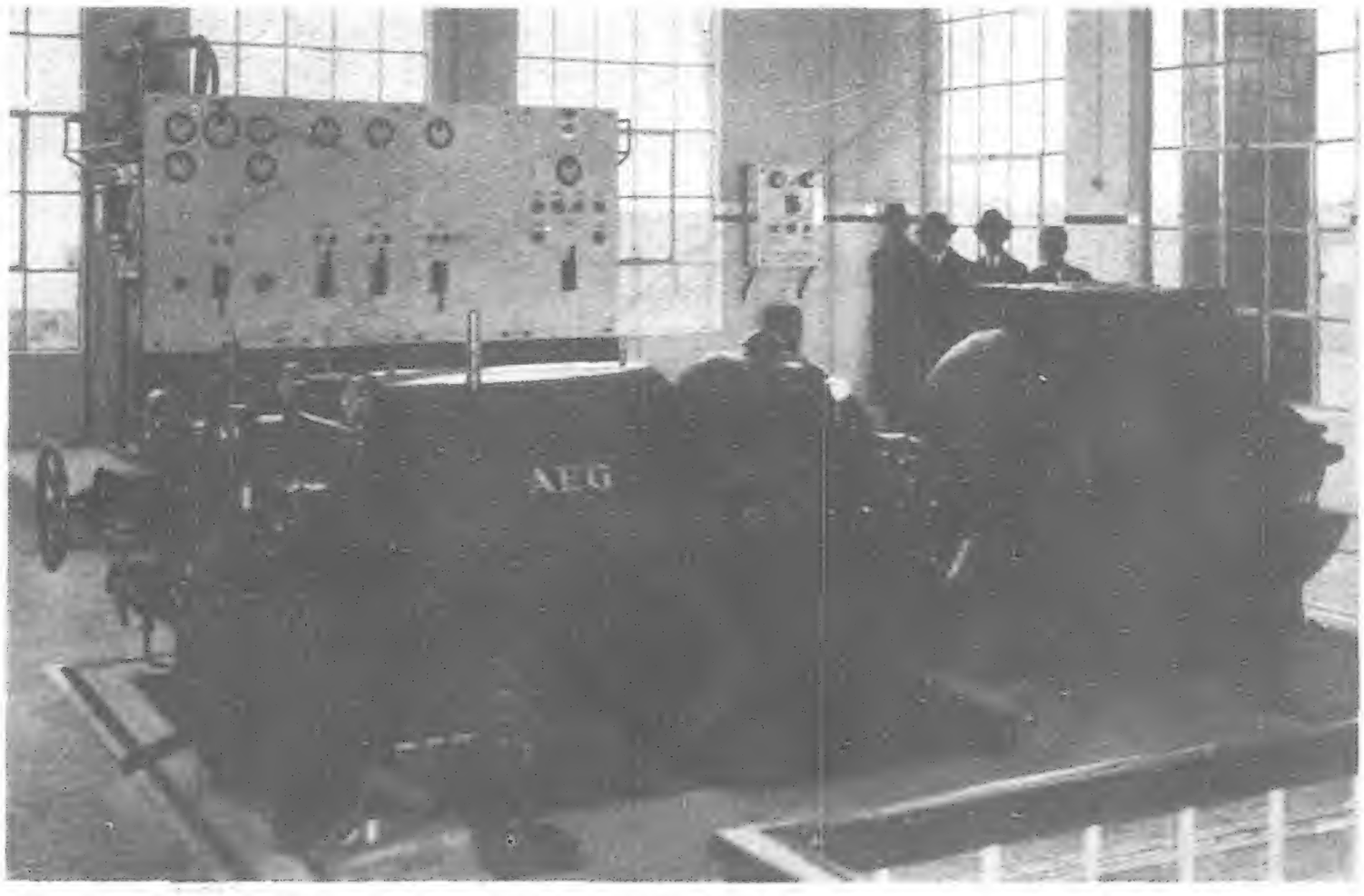


Fig. 2.—400 kw. AEG Back pressure turbine in the power station of the new Alcohol Distillery in Pootung

(Continued on page 237)

Gold in Burma and the Shan States

A Description of the Known Gold Occurrences of Upper Burma and the Shan States

By J. COGGIN BROWN, D.Sc., M.I.M.M., in the "Mining Magazine"

(Continued from May, 1935)

(2) This range is the watershed between the Upper Chindwin and the Mali Hka, the westernmost of the two branches of the Irrawaddy.

(3) The rocks of this part of the Hukawng Valley, sedimentary, metamorphic, and igneous, and its geological history are very similar to those of the auriferous region of the Upper Uyu Valley.

(4) Igneous rocks of Tertiary age are developed on a large scale. Thus, the elongated dome of Kawtta Pum, a prominent topographical feature, rising 4,606-ft. above sea-level in the eastern Hukawng, is for its upper 2,000-ft. built entirely of volcanic breccia, fine-grained tuffs, and solidified ash, while lower down and cropping out in some of the gold-bearing streams, such as the Kapdup, these volcanic rocks are interbedded with Lower Tertiary strata.

(5) The close association of the gold and the volcanic rocks and its bearing on future prospecting are apparent. The possibility of gold-bearing alluvial deposits underlying those portions of the Hukawng plain into which these tributary streams debouch should not be overlooked.

GOLD-BEARING GRAVELS OF THE IRRAWADDY RIVER.—In the north the basin of the 'Nmai Hka, the eastern of the twin rivers which later unite to form the Irrawaddy, extends to Lat. 28° 40', a little known region where Burma and Tibet meet. The western branch, the Mali Hka, does not quite reach the 28th parallel. Flowing south from their gathering grounds on high, snowy alps the two rivers are separated for some 300 miles by a narrow belt of mountains, 30 to 35 miles across, until the eastern stream, the 'Nmai, turns abruptly to the west to meet the other at the confluence, 25 miles north of Myitkyina and the commencement of the Irrawaddy proper (Fig. 6). (Myitkyina is the terminus of the Burma Railways, 725 miles north of Rangoon and about 1,000 miles by river from that seaport.) Both the 'Nmai and Mali Hkas are torrential streams (Figs. 7 and 8) liable to great floods, flowing in narrow, rocky valleys, but that of the Mali, which has the smaller volume of water, is broken by the Putao plain, in which lies Fort Hertz, the most northern outpost of Burma and 220 miles north of Myitkyina. Across this plain, 1,100-ft. above sea-level, 26 miles long and 8 miles wide, the river meanders and has deposited gravel terraces. Further south, however, its smoother reaches are interrupted by rapids.

Fig. 9.—The Irrawaddy at Myitkyina

Fig. 10.—The Nam Hpalak in the Hkamti Plain (the village of Putao on right)

Fig. 11.—Third defile of the Irrawaddy, between Myitkyina and Bhamo

At the confluence, to which launches can ascend from Bhamo in the dry season, a distance of 150 miles, the river is about 450 yards wide and has a maximum depth of about 30-ft. in January. Flowing south, past Myitkyina (Fig. 9), at first through hills and later in more open country, the channel widens to as much as 1,000 yards. At Sinbo it is half a mile wide and just below this place the third defile begins with a mouth of 50 yards! Measured in terms of its annual discharge the Irrawaddy is the fourth largest of all the great rivers of Asia and at Bhamo has been estimated to carry one million cubic feet per second at high flood. During such times the conditions at Sinbo, where the river has been known to rise 80-ft. in one night, may be imagined better than described. The defile has a length of 30 miles and is nowhere more than 150 yards wide, in places narrowing down to 50 yards (Fig. 10). Yet, 10 to 12 miles east of the defile and approximately parallel with it is a broad open plain, the old course of the river, at the southern end of which Bhamo is situated. The causes of this extraordinary behaviour on the part of the river, which

are not without significance in a study of the distribution of the gold-bearing terraces, have been discussed by J. M. Maclaren* and by the author.†

From Bhamo, at a height of 350-ft., to the sea, a distance of 900 miles, large river steamers ply all the year round. Below the first defile the channel widens and the river turns to the west to enter its second defile near Sinkan, a much shorter, wider, and less spectacular one. Near the exit of the second defile, at Shwegu, and elsewhere gold washing has been practised by the Burmese in the past, while the streams joining the main river around Bhamo itself are considered in a later paragraph.

Turning now to the Irrawaddy above the third defile, though the fact that the region produced gold was known authoritatively in the fifties of last century it was not until 1892 that the question was first investigated. In that year C. L. Griesbach, who later directed the Geological Survey of India, described‡ how widespread alluvial deposits occupy the troughs of the great river and its minor tributaries hereabouts. From 10 to 20 miles across the trough (the old channel east of the third defile) is partly filled by almost horizontal, bedded deposits. "The formation is of some economic importance," wrote Griesbach, "as it contains a not inconsiderable amount of gold disseminated through it in fine dust." He described the native method of washing by means of a cradle and put down their earnings as about 4 to 12 annas per man per day. He noted that they confined their attention exclusively to the most recent accumulations of sand and grit stranded on the upper reaches of banks in the river itself and nowhere dug deeply into the recent or sub-recent deposits. He himself found gold in well-rounded, water-worn leaflets of minute size in such situations and concluded that it seemed highly probable that within the sub-recent gravels and clays of the Upper Irrawaddy a horizon may exist in which gold is more plentiful and which might pay if regularly mined on a larger scale.

Fig. 12.—The Namma Gold Dredge

The chance meeting on an Irrawaddy River steamer in 1900 of Mr. W. R. Moore, who already had experience of gold dredging in New Zealand, and Captain J. Terndrup led directly to large-scale dredging in the upper valley of the river. J. M. Maclaren has given an account of these operations up to 1906,§ while W. R. Moore has reviewed¶ the operations during his period of management, ending in 1909. The main points in the history of the undertaking are summarized below and the reasons for its failure to make good are discussed in the light of the knowledge possessed to-day. Moore commenced by examining the river bed between Myitkyina and Sinbo. In every locality examined near rapids and on beaches, exposed to the rush of the stream, he found colors of light, flaky, "float" gold, but below Myitkyina generally the gravel areas were too huge and the gold too fine to be attractive and he turned his attention upstream above the town. The immense gravel terraces of this portion of the river rise in places 30-ft. above low-water mark. Colors were found everywhere and in favorable spots below rapids and in crevices phenomenal "dishes" were obtained. The gravels of both streams at the confluence yielded good samples and no "shotty" nuggety samples were obtained. No figures are given, but the official view is that the gravels are worth three grains per cubic yard on the average The material is clean, easily worked, and there is but little barren over-burden. In 1901 Government granted Messrs. Moore and Terndrup a five years' licence for dredging in the river-bed for some 120 miles, from the confluence to the mouth of the Taiping, near Bhamo. They formed a small private syndicate and in 1902 a 4½ cu. ft. pilot dredge, bought in New Zealand, was erected on the spot and operations commenced 10 miles above Myitkyina. All the gold won was fairly light, but the gravels were deep and this machine, limited to 30-ft. below low-water level, did not always work on the bottom.

In the same year the licence was extended for 30 years, the portion below and including the third defile abandoned, so that the lease was now restricted to the river between Sinbo and the confluence. In 1904 the Burma Gold Dredging Co., Ltd., was registered with a capital of £120,000, half of which was offered at first and quickly taken up in Burma. A very large area of easily-washed alluvial ground had been proved and, though it did not promise spectacular returns, it was hoped by putting through large volumes of gravel to ensure steady profits. A second 7 cu. ft. steel-hulled dredge, built in Scotland and erected in Rangoon, was towed upstream and commenced work in 1905. A third, erected, as all the later ones were, at Myitkyina, followed in 1906. Their work proved that the confined parts of the river were generally swept quite clean of gravel, while in the deep pot-holes rich ground was obtainable to the utmost extent of the dredge ladders. In 1907 a fourth dredge, again of the same capacity, started and about this time 15 miles of the southern downstream end of the concession were exchanged for ground above the confluence, 10 miles along the eastern river, the 'Nmai Hka, and 5 miles along the western, Mali Hka. The first dividend was declared in 1908. All the dredges now at work were steam-driven and the supplies of the necessary wood fuel were a source of endless worry to the company. In 1908 a 10 cu. ft. steel dredge, with Crossley gas engines, was started. This machine worked to a depth of 55-ft. and, it is claimed, operated at a cost of under 1½d. per cubic yard treated, including upkeep and amortization charges. In the meantime the recovery of gold had been steadily increasing, reaching its maximum of 9,041 oz., valued at £34,657, in 1909.

Fig. 13.—Loi Twang. Gold bearing alluvial deposits underlie the terraced rice fields

Geog. Journ., xxx, 507-511.
†*Rec. Geol. Surv. Ind.*, xliii, 178-180.
‡*Rec. Geol. Surv. Ind.*, xxv, 1892, 127-130.
§*Loc. cit.*, pp. 266-7.
¶*Min. World*, cx, 1926, pp. 151-12, 175-6, 202-3, 223-4, 246-7.

The original company was liquidated in 1911 and a new one formed under the title of Burma Gold Dredging Company, 1911, Ltd. Production now began to fall and, although application was subsequently made for a further exchange of the Irrawaddy portion of the concession for 15 miles along the 'Nmai Hka, while the official records of 1915 and 1916 show that further prospecting licences were issued matters went from bad to worse and operations ceased in 1918. Mr. Moore's remarks in this connection may be quoted: "Burma Gold Dredging Co. changed horses crossing the stream at a critical moment of its existence and years of work were thrown away. Continuity of management went and new half-baked ideas were adopted. It was almost inevitable under the circumstances, but it should have been avoided. Economies were effected, but yearly returns dropped in greater proportion, a good staff was soon dispersed and an excellent plant was either lost or dispersed." Altogether the two companies recovered a total of 56,624 oz. of gold, valued at £217,381, the average for the six years, 1908 to 1913, being 6,588 oz. (£25, 264).

Fig. 14.—Gold-bearing valley deposits in Mong Long, Northern Shan States, showing dumps of Shan workings

The reason for the failure to obtain better results after the change-over has been officially attributed to the lowering of the grade of the wash remaining to be worked. In other words the quality rather than the quantity of the gravel began to fail. This, however, seems unlikely under the conditions which existed and the result would have been the same if the average recovery of the dredges began to diminish. Other causes which have been advocated include loss of dredging time through floods, mechanical failures, fuel shortage, malaria, failure to recover the fine gold, and lack of knowledge of the deposits.

In favorable years of light rainfall less time was lost through floods than might be imagined and records of 42 weeks' work out of 52 for individual dredges were sometimes obtained. These, however, were exceptional. The first of the swift rises of the river in June is always the most risky, as quantities of floating timber are borne along and foul the long head and side mooring lines. To save loss of dredging time in floods, which must always remain one of the more serious difficulties on the Irrawaddy, attempts should be made to find profitable ground in the alluvial deposits close to the river bank, where the boats could be usefully and safely employed during such periods. The obvious place in which to look for them is along the old course of the stream before it took to its defile. As far as the author knows no attempt has ever been made in this direction.

It is unquestionable that on the larger islands and beaches, where the gold was finer than usual, the dredge recoveries were poor and uniformly much below legitimate anticipations from the prospecting results. Many experiments were made in the finer adjustments of the gold-saving boxes and tables, but none proved effective. The worst obstacle was the abnormally high proportion of black sand, which choked the fabrics designed to catch the fine gold, rendering them smooth enough to be almost useless. Years before the end the author recommended the use of mercury to Capt. Terndrup and it was tried in both boxes and tables, but here again the sand was stated to have prevented contact. This is a problem which must be solved if dredging is ever attempted again, particularly on the deposits below Myitkyina. The action of the company in removing the screens and gold-saving tables from some of the dredges and substituting sluice-boxes for them was not helpful in this respect.

Lack of knowledge of the deposits and of their origin can hardly be advanced as a charge against a management confronted with pioneering in a country about which even the most elementary geological data were unknown. At that time the prevalent belief, correct as it happened, was that the higher the main river or its branches could be ascended the richer the gravels would prove to be. The multiplication of the working difficulties in such situations was not sufficiently realized: indeed there must soon come a limit in both sister streams where the movement of heavy dredges is impossible. In the endeavour to reach these higher locations as soon as possible too little attention seems to have been paid to the larger admittedly lower grade but more easily-worked beaches further downstream. The history of the numerous changes in the limits of the concession confirms these impressions. In the higher locations themselves, for reasons given below, the author thinks that concentration of attention on the 'Nmai Hka instead of on the Mali Hka was an error of policy.

"The writer has always been convinced," states Mr. W. R. Moore, "that if the company had started operations in 1907-08 instead of 1903-04 it would have still been operating at a profit. Then we should have started with 10 to 12 cu. ft. dredges driven by gas engines instead of 7 cu. ft. buckets driven by steam. Force of circumstance drove us to installing gas and a 10 cu. ft. bucket dredge. This proved to be a much more efficient and economically run unit."* If any attempt is made hereafter to recommence gold dredging in the Upper Irrawaddy there is much to be learnt from the experience of the Burma Gold Dredging Co., Ltd., and this section of these notes may be concluded with another quotation from Mr. Moore's writings, with which the author is in complete agreement: "Perhaps some day the industry may revive, for assuredly there are huge areas of alluvial that only wait on improved methods to make them payable."†

Fig. 15.—Shan Gold Washers

Loc. cit., p. 223.
†*Loc. cit.*, p. 247.

ORIGIN OF THE IRRAWADDY GOLD.—According to J. M. Maclaren,* the "Miju Ranges," which lie transversely across the head of the Assam valley and on the south-eastern slopes of which the headwaters of the western branch of the Irrawaddy rise, give considerable promise of mineral deposits of economic value. The schists, where he saw them, contained merely lenticles and stringers of quartz and no true quartz veins, but they are nevertheless the probable source of all the gold that is now so widely scattered over the Upper Assam valley. Until recent years much the same idea prevailed amongst geologists regarding the Irrawaddy gold.

In 1917-18, however, Dr. Murray Stuart, to whom we owe all our existing knowledge of the geology of the extreme north-eastern frontier of Burma, ascended the valleys to the north of Fort Hertz and made traverses up to Lat. 28°. The whole country proved to be built of a metamorphic series of schists, slates, and phyllites, widely and profoundly injected with intrusive rocks, granites, syenites, peridotites, and andesites, the exact relationships of which have still to be determined.† Stuart found that Lisu tribes people travel up the 'Nmai Hka and wash the alluvial deposits about high-flood level for gold. Their takings are very small and from his own panning results he condemned an occurrence at Pasang Wang on the left bank of the river, about half a mile below the junction of the Nam Tamai (the main north-westerly branch of the 'Nmai Hka itself) and the Taron, which enters from the east. There is no record of gold in the Nam Tamai and Stuart therefore concluded that it came down the Taron.‡

Gold is reported to exist in the Akyang valley, which lies between the 'Nmai Hka and the frontier, within British territory, approximately about Lat. 27° to 27° 30′. On the authority of the chief civil officer in Putaok, at Fort Hertz, it is known that parties of Chinese cross the border and wash for gold in this region every season, treating the eluvial deposits of the slopes, according to one report, by diverting the mountain torrents and obtaining both gold nuggets and dust and, according to another, carrying on their alluvial operations after their more usual methods. On geological grounds Stuart favours the second view, but he did not visit the valley. The fact remains that he was shown nuggets, one of which was almost an ounce in weight, reputed to come from it and, although its isolation might well make any attempted exploitation difficult if not impossible at present, it is all the more desirable that the subject should be investigated, the exact localities worked by the Chinese past and present tabulated, their methods described, and the amount of gold which they remove annually estimated.

Stuart makes no mention of gold in the Mali Hka and there are no records in literature that gold has been sought for in Hkamti Long. It is important, therefore, to be able to announce here, for the first time, on the authority of Mr. W. A. Hertz, that the upper valley of the Mali does contain gold; the highest tributary in which he has actually seen washing carried on lies to the east of the fort named after himself, though it is possible that still higher ones are also auriferous. Now, if the streams flowing into the Hkamti (Putao) plain are gold-bearing, its alluvial deposits and more particularly the older terraces merit careful examination, for it is the first and only basin of deposition of any consequence between the ultimate sources of the Irrawaddy and the neighborhood of Myitkyina. (See Fig. 11. This photograph and all the others in this section were taken by Mr. Hertz. It illustrates the sluggish character of the streams crossing the Hkamti plain).

That some of the gold in the Irrawaddy is derived from the ancient crystalline rocks is undoubtedly true. Though the following two localities are situated a long way further south the comparison holds good for the north. Griesbach, in 1892, satisfied himself that gold occurred in the gneiss in very minute quantities, at a place where it was being worked at that time near Myothit, Bhamo district.§ Chhibber, in 1931, visited old workings in schists near Woragahtaung, Myitkyina district (25° 25′: 96° 17′). At the same time igneous rocks of Tertiary age must be regarded as an additional if not the more important source, for recent work has shown that they occur at intervals in a zone striking north-east and east through the Katha and Myitkyina districts, across the Hukawng valley, and into the Chinese province of Yunnan, where they may eventually prove to have a greater extension to the north than the author's own surveys around Teng-yueh proved. The implications of Chhibber's localization of the auriferous streams of the Hukawng valley and their association with a grand development of such igneous rocks lead to the question whether the streams flowing to the south-east from the central and southern portions of the Kumaon range, into the Mali Hka, are carrying gold into that river. They enter it between the confluence and Lat. 26° and should be one of the first objectives of a prospecting campaign in Myitkyina district.

GOLD OCCURRENCES IN TRIBUTARIES OF THE IRRAWADDY IN BHAMO DISTRICT.—The southern portion of the long open plain which forms the old course of the Irrawaddy and lies 10 to 12 miles east of the third defile is now occupied in part by its tributary the Mole. This stream enters the plain from the frontier hills on the east, near Nalon, about 35 miles north-north-east of Bhamo, and in the vicinity gravel terraces occur which are treated by native methods from time to time. According to Maclaren they were thoroughly prospected with a Keystone drill and were considered to be valueless when he wrote in 1938.¶ He thought that these gravels were possibly a re-wash of ancient, highlevel Irrawaddy gravels, the great river having flowed here under the Chinese frontier hills before it forsook its broad flood plain to cut through the narrow third defile. Gold-washing operations have also been carried out in the past near Myothit, some 30 miles north-east of Bhamo, where the Taiping, an important trans-frontier tributary, enters the same plain. The author is acquainted with the Taiping valley, both in its course through the hills, where it is a swiftly-flowing mountain stream, full of rapids and cataracts and often constricted in narrow gorges, and in the Chinese Shan States beyond the frontier, where it is a placidly-flowing river traversing plains bordered by high terraces of ancient fluvio-lacustrine deposits. His panning tests in the bed of the first part of the valley yielded no trace of gold, neither is gold washing practised in the Chinese Shan States concerned. The inevitable conclusion is that the auriferous gravels of Myothit, like those of Nalon, originated at an earlier stage in the history of the Irrawaddy itself and it is reasonable to suppose a similar development for the gold-bearing gravels below the second defile near Shwegu.

In a paper entitled "Mining Possibilities in Burma" H. D. Griffiths** has discussed these deposits at length and come to very different conclusions regarding their value. He regards the alluvial gravels as re-sorted fluvio-lacustrine deposits spread across the Irrawaddy valley and remarks that for many years past the terraces of the "original detrital wash" have been exploited on the flanks of the hills by native methods in innumerable pits and quarries, though in the flats, owing to their waterlogged condition, no work has been done. "The gold wash in the flats," writes Griffiths, "is undoubtedly a re-sorted deposit from which have been eliminated certain enclosures of friable and easily-decomposed rocks, which are found in the original deposit in a very decomposed state, thus leaving water-worn enclosures such as quartzite, hard schist, and quartz." The rock decomposition here referred to is interesting in that it tends to confirm the theory that old, high-level terraces of the Irrawaddy itself are being dealt with rather than accumulations washed in more recent times from the frontier hills by the tributary streams themselves.

Griffiths explored this terrain for over two years and amongst his conclusions the following may be mentioned here: The terraces are richer than the re-sorted wash, although the latter carries gold from the surface. The increase of its gold contents with depth is very rapid. In the Mole River area the wash at a distance of 2½ miles from the foot of the hills does not show any appreciable decrease in values as compared with the nearer ground. The flats above the defile are considered the most promising. Extensive sluicing tests on the terraces yielded values of 8 to 11 grs. per cubic yard, while a large number of bores in the flats gave an average of 6 to 8 grs. per cubic yard and are said to have proved conclusively that from the foot of the hills the bed-rock slopes at so slight an angle that at a distance of 2½ miles it lies at a depth of only 60 ft. More explicit details are given regarding the values and quantities of available ground in three areas where the Taiping, Mole, and Namsang streams emerge from the hills and to these the interested reader is referred.

GOLD OCCURRENCES OF THE FEDERATED SHAN STATES.—Small quantities of gold can often be panned from streams draining those parts of the Shan States which are occupied by rocks belonging to the Chaung Magyi series, alternations of mica schists, phyllites,

*"Geology of Assam," *Rec. Geol. Surv. Ind.*, xxxi, 184.
†*Rec. Geol. Surv. Ind.*, liv, 1922, 398-409.
‡*Rec. Geol. Surv. Ind.*, l, 1919, 252-3.
§*Loc. cit.*, p. 130.
¶*Loc. cit.*, p. 267.
**THE MINING MAGAZINE, XXV, 1921, 229-238.

slates, and quartzites, often traversed by this quartz veins and frequently intruded by dykes of tourmaline granite. The gold tends to occur more in those areas where the Chaung Magyi rocks are of an arenaceous character. These ancient strata were consolidated and folded, dislocated and denuded before the earliest Palœzoic sediments of Ordovician age were laid down upon them and they are only exposed where the overlying mantle of younger rocks has been removed—as, for instance, along the western edge of the Shan Plateau, on its eastern margin, and in certain highlands which corrugate its surface in places, where they occupy the cores of elongated domes.

Gravels of the Nam Ma.—East-north-east of Lashio, the administrative headquarters of the northern group of States and some 45 miles away from it, is a small easterly-flowing tributary of the Salween, known as the Nam Ma, the head-waters of which drain an area composed of these rocks. The older terraces and the recent alluvium of this stream are auriferous and were at one time worked by Chinese gold miners. About 30 years ago they were systematically pitted by a competent European engineer on behalf of a Rangoon firm and the Namma Gold Dredging Company was registered in 1905, after some 40 million cubic yards of ground had been proved, the average value of the whole of which was estimated to be 5.43 grains of gold per cubic yard. A cart road was constructed to the valley and a dredge erected on the spot (Fig. 12). It was soon found, however, that infiltration of the gravels by calcium carbonate from a neighboring limestone spread had consolidated them sufficiently in places to make dredging impossible and the enterprise was abandoned. The author visited this area before the dredge stopped and can bear witness to the careful manner in which the prospecting operations had been carried out. It is difficult to understand why no later attempts have been made to investigate this particular occurrence with a view to over-coming the local difficulties.

Gold Occurrences of Loi Twang.—Fifty miles south-east of Hsipaw, to capital of the State of the same name, there is a lofty mass of hills rising to 6,672 ft. above sea-level from the undulating plateau around. They are composed of micaceous slaty rocks of the Chaung Magyi series and from them has come the gold of the alluvial deposits near Hwe-pen (22° 15′ : 97° 48′). Further south in the Mong Kung and Kehsi Mansam States these rocks assume a sandy facies and build the whole of the short range in which the mountain Loi Twang (5,752 ft. 21° 56′ : 97° 43′) is situated. All the streams draining these rocks carry gold and the alluvials have been worked by the Shans from time to time. The region was examined in 1906 by T. D. La Touche, who concluded that the values are far too low to warrant large-scale working and did not amount to as much as 2 grains per cubic yard. At the same time it must be pointed out that his samples were drawn mainly from the shallow, upper portions of the terraces. "In most cases," he writes, "the influx of water was so great on reaching the gravel that the pits could not be carried more than 3-ft. or so into it and it was very seldom that the bed rock was reached." The gold generally occurs in thin spangles and in three of the streams concerned—the Namhkam and Nam Ka in Mong Kung and the Hwe Aw in Kehsi Mansam—is coarse and, as far as La Touche's shallow tests showed, confined to a very small area in each case. It is noteworthy that very little gold occurs in the recent gravels, except in the case of the Nam Ka, which is a fair-sized stream and probably the only one which contains sufficient water for dredging, should later work prove that the lower portions of the terrace gravels are sufficiently rich and extensive to warrant it.* Fig. 13 is a photograph of Loi Twang from the south-east, by T. D. La Touche. The gold-bearing gravel lies under the terraced rice fields in the foreground.

Gold-Bearing Gravels of Mong Long.—In 1912 the author examined a number of localities in the Mong Long Sub-State of Hsipaw, about Long. 96° 39′ and between Lats. 22° 38′ and 22° 42′, where gold washing was being carried on by Shans at that time. The country is exceedingly broken and its narrow winding valleys, separated by high steep-sided ridges, are covered from top to bottom with almost impassable forest. The local rocks are quartzites, greywackes, slates, and sandstones of the Chaung Magyi series. The gold was found in older gravel deposits as small flattened particles of $\frac{1}{16}$ to $\frac{1}{8}$ in. long and in tiny rounded grains. Fine gold dust was absent. The average contents of separate flats in various stream-beds ranged up to a maximum of 9.68 grs. per cubic yard, but in no case were the areas concerned more than trivial and dredging or hydraulicking such small patches was out of the question. The writer recommended that the gravels might well be left to the Shans to exploit in their accustomed manner (Fig. 14). At the same time it was pointed out that the larger streams of this and adjoining districts are worthy of examination, because there were greater chances of larger areas of profitable gravels, with a more even distribution of gold values, being discovered in such situations than in the small tributaries, which often have a rapid current and are usually little more than mountain torrents.

Gold Occurrences of other Parts of the Shan States and Adjoining Regions.—The occurrences which have been briefly described are by no means the only ones known, for small amounts of gold can generally be panned from streams draining the slates and quartzites, with their associated quartz veins of the Chaung Magyi series, as, for example, in the eastern band of these rocks which culminates in Loi Ling, 8,771-ft., in South Hsenwi. In such regions gold-washing is often practised by the natives in a desultory fashion, more as a form of casual employment with a sporting chance of reward when routine agricultural operations do not claim first attention rather than as a settled occupation (Fig. 15) Old workings are, therefore, found in many places, but as a rule they merely betray the original presence of small prospects of no particular interest to the European miner. Amongst the valleys of the larger rivers which warrant more consideration in the future is that of the Shweli, the river which crosses the Chinese frontier hear Namhkam and flows to the south-west, through the Mong Mit State, before turning north to join the Irrawaddy below Katha. According to Maclaren large and heavily-mineralized gold-quartz veins of very low grade occur in the gneissic range which lies to the south of this river in the Northern Shan States. From time to time prospecting licences have been taken out for the examination of alluvial deposits in various parts of the river bed. In 1932 it was proposed to exploit one area in which coarse gold was reported to occur on a large scale by means of gravel pumps, but, according to information lately received from Burma, this was not done. Again, in 1933, some activity prevailed near Webaung, 20 miles west of Myitzain, where there are gold-bearing gravels, though here lateritic clays have interfered with sluicing tests. Gold has also been reported from several other places in the Shweli watershed, but until the geological survey of the whole of its valley has been undertaken the prospects of the deposits concerned will remain problematical.

Auriferous gravels are known to occur in the tributaries of the Salween which enter the river from the east through the Wa States and it is to be hoped that they have been properly examined during the recent expeditions into this little-known region.

Further to the north again Dr. M. R. Sahni has recently drawn attention to the presence of alluvial gold in several streams draining Chaung Magyi rocks in the Namhkam region, as, for example, in the bed of the Nam Lawng, south of Urapum (23° 41′ 30″ : 97° 53′ 30″) and south-south-west of Hkamtaw (23° 41′ : 97° 53′), but the main gold-bearing region, it is stated in the Annual Report of the Director of the Geological Survey of India for 1933, lies to the east of Survey of India Sheet No. 93/E/13, where we are informed in the same place the Burma Corporation, Ltd., and others have been carrying on intensive prospecting for some time. Beyond the fact that the localities must lie to the east of the 98th parallel of Longitude it is impossible to state from the meagre details given whether they are in tributaries of the Shweli or of the Salween, with a probability in favor of the latter river. Fairly large pellets of gold were brought to Sahni by the local Shans for examination. It is added that the area was apparently worked in former times by Chinese, as traces of their diggings still exist, and that certain localities which they overlooked, or could not reach, are reputed to be rich.

Turning now to the other extremity of the territory which we are now considering, extensive ancient workings, some of them on quartz veins, are believed to exist in those portions of the Karenni States which border the Siamese frontier, another region which has not yet been investigated by the Geological Survey.

A little further to the north-east, and perhaps entirely in Siam, there are old Chinese gold diggings in the frontier hills west of Muang Fang, a town in Northern Siam, some 20 miles east of the frontier in Latitude 20°. It is possible that the auriferous zone on which these lie crosses into the Southern Shan States and its extension should be looked for about the neighborhood where the borders of the Mong Pan and Keng Tung States approach the frontier of Siam.

The photographs illustrating this article have kindly been supplied by Mr. T. H. D. La Touche, Mr. G. H. Tipper (Minerals Adviser to the High Commissioner for India), Mr. C. M. P. Wright, and Mr. W. A. Hertz.

Rec. Geol. Surv. Ind., xxxv, 102-113.

Nanking is Extending Power Facilities of its Electrical Plant*

THE boiler plant of the 10,000 kw. extension now being made to the Nanking central station consists mostly of American equipment in contrast with equipment of German make in the original section of the station. Steam is supplied by two steam generators, each rated at 100,000 lb. per hr (132,240 lb. maximum capacity), each served by two air-swept tube mills and corner fired by duplex tangential burners. A high ash, local coal is burned and, in order to care for both the present and anticipated load demands, the boiler plant was designed for a wide range in rating.

The Capital Electricity Works, which serves the municipality of Nanking, China, has for some years operated with a steam station containing two 70,000 lb per hr cross-drum, sectional-header boilers of Borzig design, fired by Steinmuller (German) forced-draft, chain-grate stokers, and supplying steam to a 2,500 kw turbine-generator. A steadily increasing industrial and domestic load, especially in the use of electrical appliances, made it necessary early in 1934 for the company to plan for an extension to the present station. These plans took into consideration not only the needs of the immediate future but anticipated the probable increase in load several years hence.

Accordingly, inquiries for equipment were submitted by the company to a number of European and American firms. All proposals were reviewed by a committee of seven appointed by the National Construction Council of China. With one or two exceptions, the boiler plant equipment finally selected was of American manufacture.

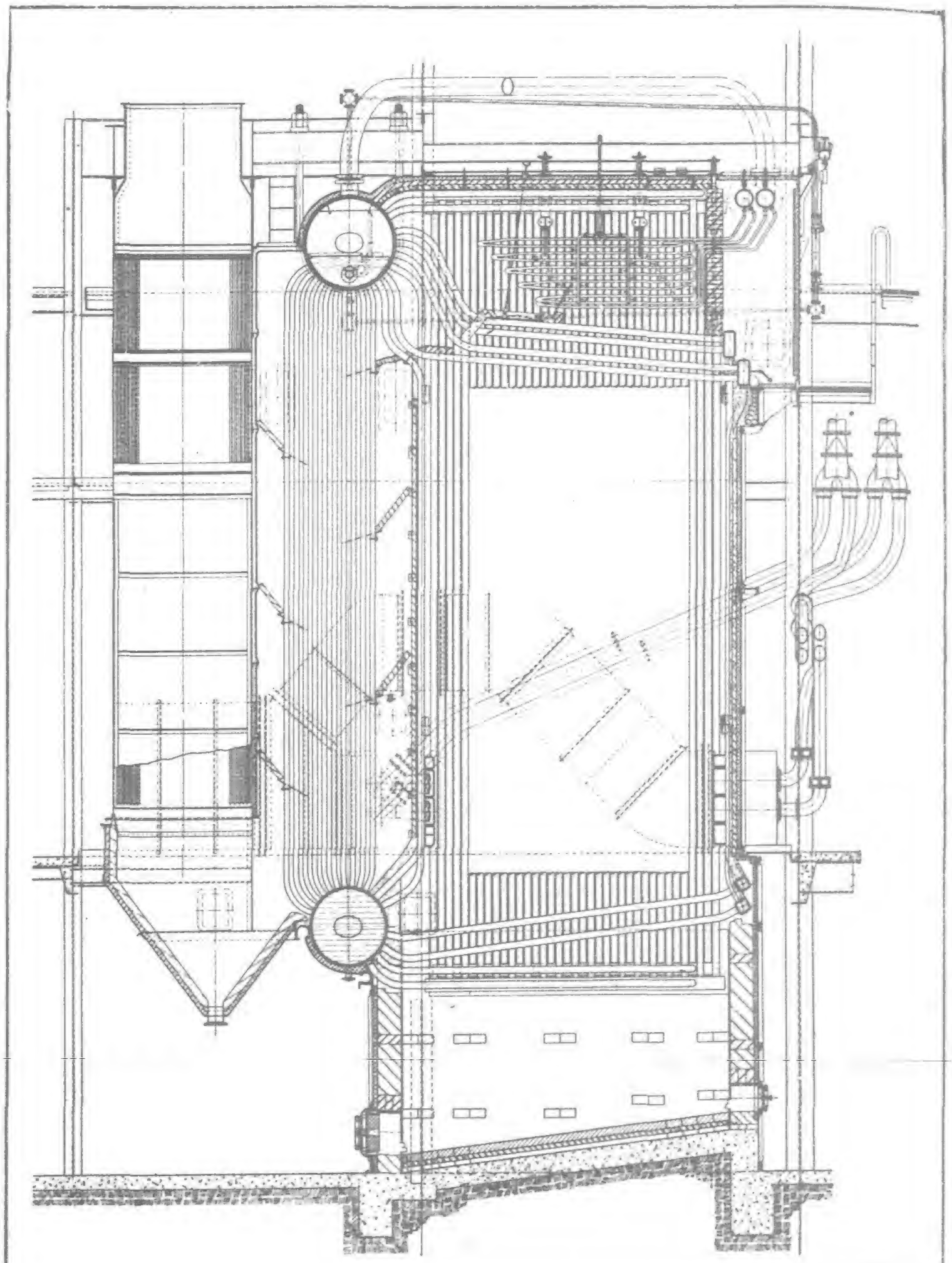
The conditions to be met involved a fairly steady load with occasional peaks. This load will be low in the immediate future, but to take care of anticipated growth two boiler units of 100,000 lb per hour continuous rating (with maximum efficiency at 80,000 lb per hour) were specified to supply 10,000 kw turbine capacity. A steam pressure for the present of approximately 400 lb was decided upon although the equipment was to be capable of operating at a somewhat higher pressure should future conditions so warrant. The Hwanan coal burned at this plant has the following proximate analysis:

Moisture	9.27 per cent
Volatile	28.49 per cent
Fixed Carbon	43.49 per cent
Sulphur	0.96 per cent
Ash	18.75 per cent

Fusing temperature of ash 3062 F

After considering proposals covering several types of boilers, with both stokers and with pulverized coal firing, the Committee finally decided upon two C-E steam generators, Kennedy-Van Saun air-swept tube mills and C-E tangential pulverized coal burners, of the duplex type, orders for which were placed through the Sintoon Overseas Trading Company last summer.

The high percentage of ash in the coal made it desirable to pay special attention to the fineness and uniformity of pulverizing, to the velocity of fuel and air and to the length of flame travel. Also, the high surface moisture and the necessity for insuring satisfactory combustion at light loads dictated the use of preheated air at approximately 400 F. On the other hand, high melting point of the ash permitted a simple ash-pit design.



Cross-section through one of two Steam Generators now being installed at Nanking, China

The steam generators are designed for 525 lb per sq. in. but will operate at 400 lb at the superheater outlet for the present and 725 F steam temperature. They may be operated at 470 lb. in the future if desired. Each has 9,542 sq. ft. of water heating surface of which approximately 80 per cent is in convection surface. There is also 2,420 sq. ft. in the Elesco superheater located upon the furnace roof tubes. The C-E plate-type air heater, located immediately behind the drums and forming an integral part of each unit, has 25,700 sq. ft. Plain tubes are used for the water walls and water screens. The upper drum is 48-in. diameter and the lower drum 42-in. diameter both being fusion welded. The entire unit, including the air heater, is enclosed in a steel casing over 2-in. of firebrick and 3-in. of rock wool.

Each furnace is fired by eight tangential burners, two in each corner, and at guaranteed rating the calculated heat release will be around 30,000 Btu per cu ft.

Inasmuch as the load will at times be light, especially during the next year or two, the units were designed for a wide range in rating, namely, from 27,600 lb of steam per hour to a maximum for two hours of 132,240 lb of steam per hr. There are two mills per boiler and the fuel piping is so arranged that each mill supplies four burners, one in each corner; that is, one mill supplies the upper

(Continued on page 237)

*Combustion

Reducing the Weight of Mine Equipment with Increased Safety and Economy

By JAMES A. RABBITT, Adviser and Acting Director, Japan Nickel Information Bureau

(Continued from May, 1935)

Some cast air-hardening steels such as the nickel-chromium-molybdenum steels, can be used for production of "monoblock" car wheels possessing a great surface hardness without brittleness in the body of the wheel. The rolling surface of the wheel is given a special heat-treatment which gives it a hardness corresponding to an ultimate strength of 150 kg/mm², while the usual heat-treatment for the body of the wheel develops a tensile strength of 95 to 100 kg/mm². This type of wheel is particularly well adapted to mine locomotives and mine cars when speeds are high and loads heavy.

Switches and Crossovers

Tramway crossings are subjected to almost incessant wear and abrasion from the wheel treads and flanges. Nickel-chromium steel is successfully employed to withstand conditions of such severity and has enabled wear to be considerably reduced. Moreover, since such steels can be satisfactorily welded by the "Thermit" process without the formation of cracks, the worn rail flanges can be built up, thus adding very considerably to the life of the track work. (Fig. 6.)

Plain carbon steel in switches and crossovers for mine tracks has proven decidedly unsatisfactory. Flattening of the frogs, deepening of the grooves, and general deformation from wear are common, with the result that cars are derailed and the whole transportation system slowed up. For a long time the 12 to 14 per cent manganese steel was the only cast alloy steel used to overcome these difficulties. This steel has a remarkable wear-resistance, but machining is difficult and in many cases it is necessary to resort to grinding; in addition it is hard to weld and has a relatively low elastic limit, hence breakage from fatigue is not uncommon. The nickel-chromium-molybdenum steel, on the contrary, besides having a high resistance to abrasion, is weldable, machinable, and has a high elastic limit. After air-quenching and drawing, its mechanical characteristics are as follows (depending on the drawing temperatures):

Ultimate strength 90 to 170 kg/mm²; elastic limit 75 to 140 kg/mm²; elongation six to 16 per cent; Brinell hardness 275 to 550; Mesnager resiliency five to 14 kgm. Thousands of frogs made of this steel have been used the last six years under very heavy traffic conditions, and their record is highly satisfactory.

Centrifugal Pumps

The bronze rotors of centrifugal pumps are often worn out very rapidly when mine conditions are such that the pump must handle large volumes of gritty water. Very frequently the rotors must be replaced every six to eight weeks if the pump efficiency is to be maintained.

Pumps made of martensitic nickel-chromium cast iron of great hardness, which have been recently introduced on the market, show great promise. The addition of appropriate amounts of nickel or of nickel and chromium to ordinary grey cast iron increases its hardness in sand pumps that must resist abrasion. They have the following composition:

3.0-3.2 carbon	0.8-1.0 manganese
1.5-1.8 silicon	3.5-4.0 nickel

0.6-0.8 chromium

After machining and quenching in air from 850°C, followed by drawing from 350-400°C, the Brinell hardness is from 300 to 350.

Crushers

White nickel-chromium cast irons containing from three to four per cent nickel, and from 1.0 to 1.5 chromium with Brinell hardness about 600 are used for crushers. These cast irons, in some cases, have shown greatly superior wear-resistance as compared with manganese or nickel-chromium steels.

Wear of perhaps a different type is prominent in another direction, namely that of percussion tools. Here, the life of a tool is dependent upon its ability to retain a sharp edge when being driven against, or through, solid metal. Toughness again is required in combination with surface hardness, since a tool may be disabled by the edge chipping (Fig. 7).

Mining drills operate in the constant presence of grit and other abrasive material which in spite of all precautions cannot but find its way into the mechanism. As the drill is operating at about 2,000 blows per minute, this entails severe wear conditions which are satisfactorily met by the employment of nickel steels.

The problem of handling such abrasive materials as siliceous limestone, granite and sandstone, has been satisfactorily overcome by utilizing the well-known wear-resistance of nickel-chromium steel. Shovels of this material have an average life of at least three to five times that of the ordinary steel shovel, and there are instances where it has been extended to as much as twelve times.

The foregoing are a few of the problems of wear which have been solved by the use of the proper nickel-containing steel. As

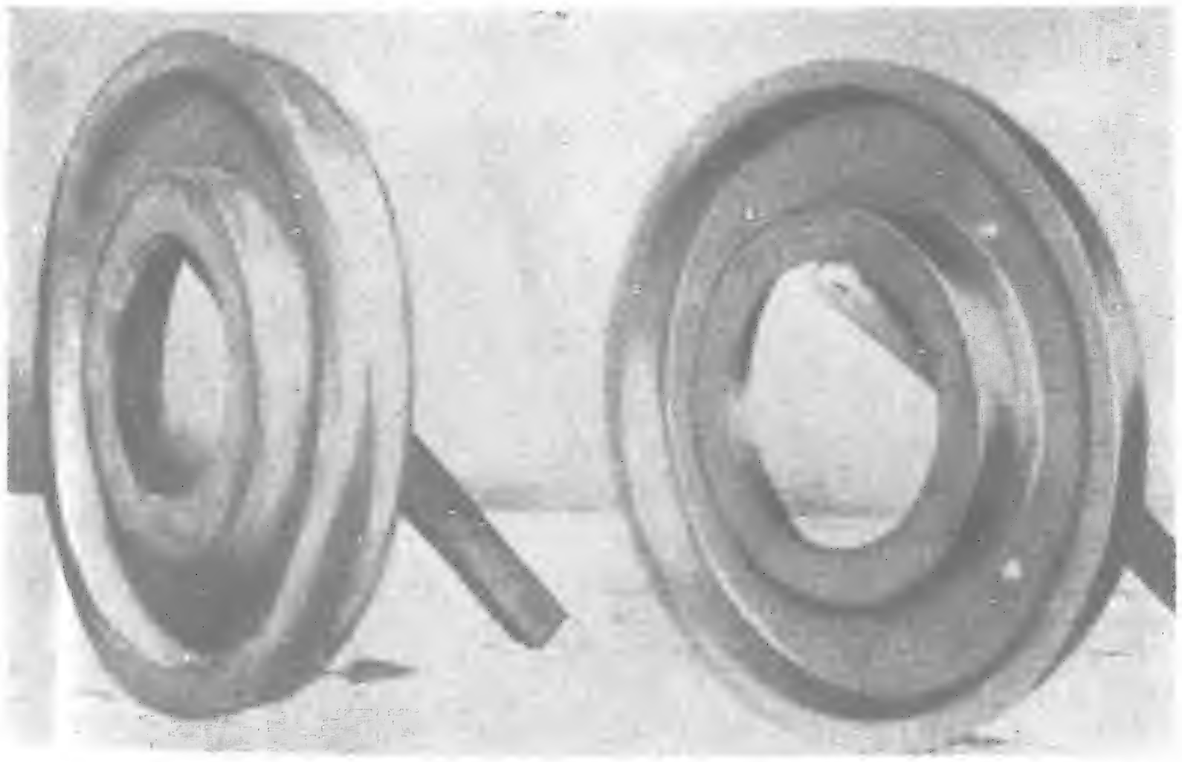


Fig. 14.—Floating Ring (rough forging and machined) as used on H.S.B. Air Compressor and Superhaul

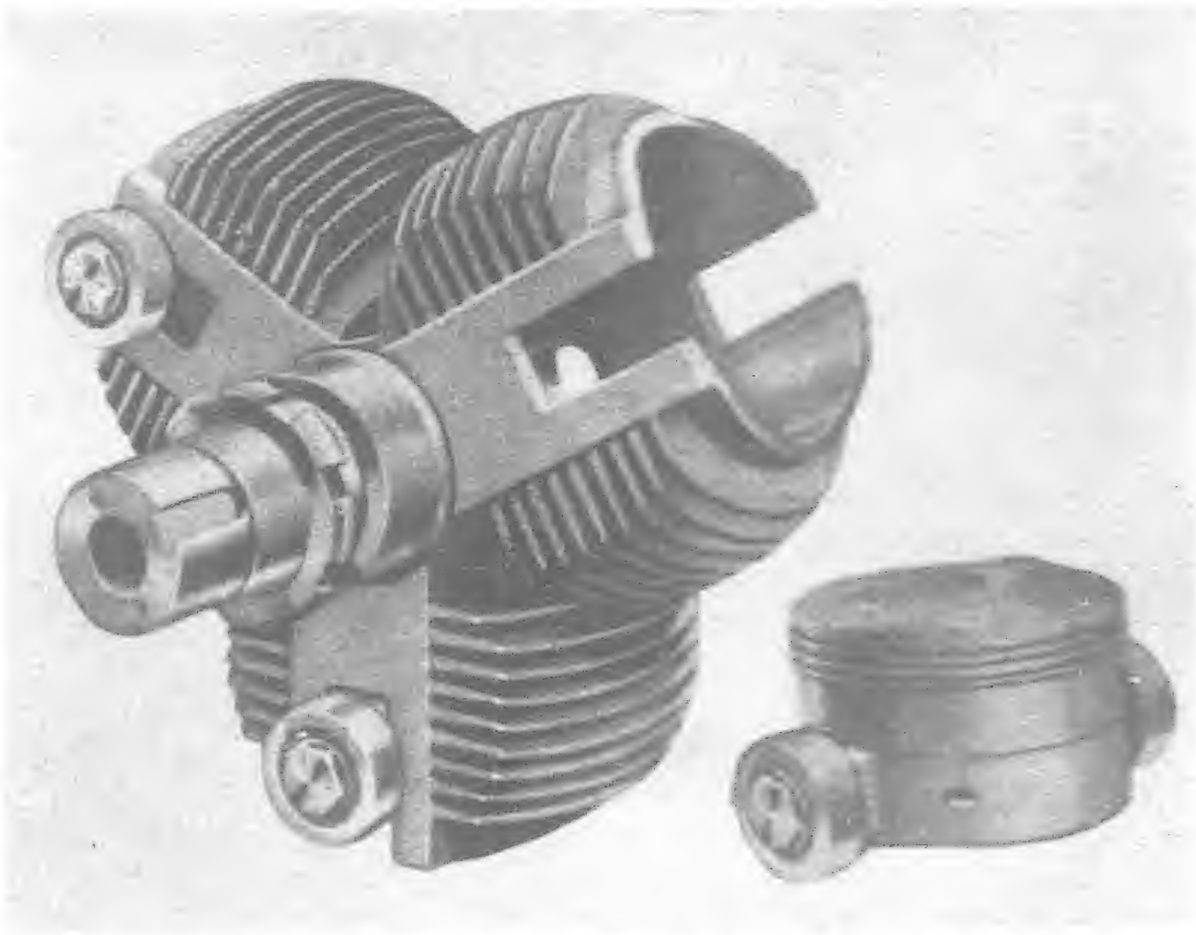


Fig. 15.—Cylinder Body and Piston of the H.S.B. Air Compressor

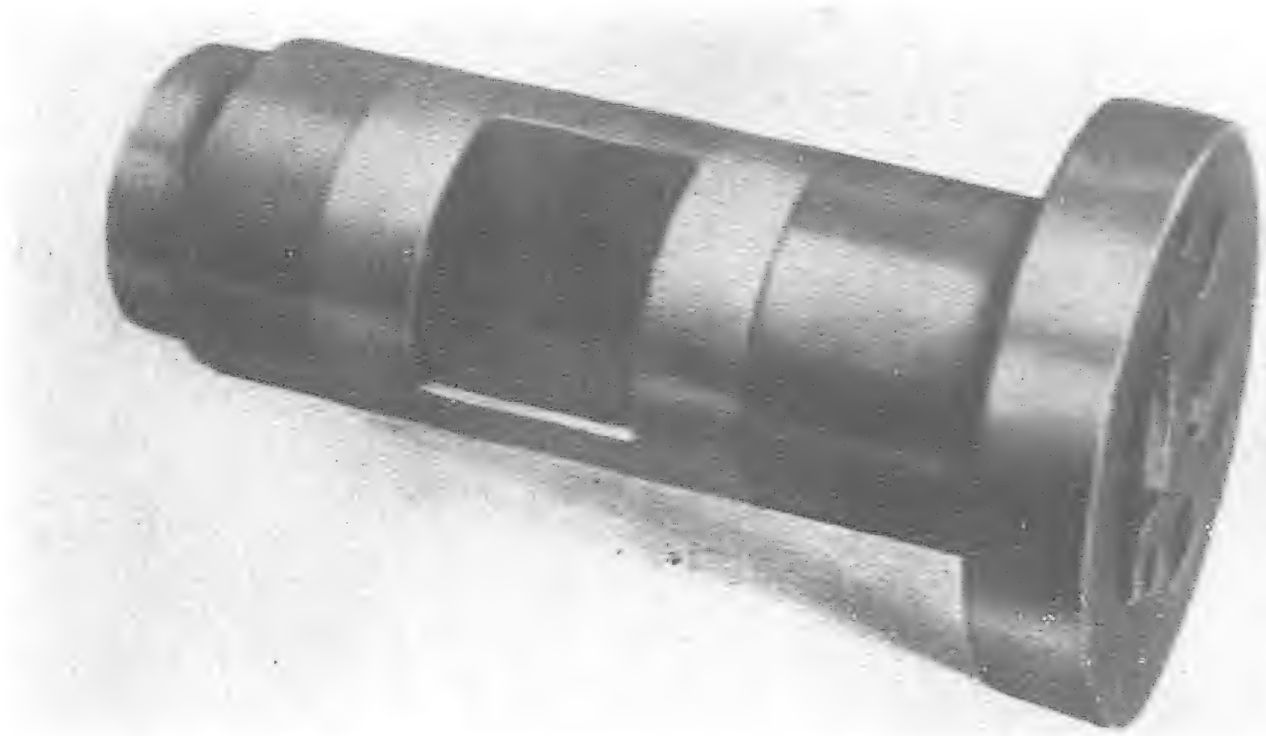


Fig. 16.—Central Valve of the H.S.B. Air Compressor

has been indicated, there are a very large number of types of wear and the same composition is not always useful. It can be safely asserted, however, that a suitable material will always be found among the wide range of steels which depend largely for their qualities upon the presence of a few per cent of nickel.

Stainless Steels and Corrosion-Resistant Cast Irons

Although the cost of stainless steels and cast irons is high, these materials have already found application in the mining industry. They are destined to become, ultimately, of common use in the industry as soon as metallurgists succeed in lowering their cost appreciably. The most generally used stainless steel is the 18-8 chromium-nickel steel (18 per cent chromium, eight per cent nickel). The most usual compositions fall within the following limits :—0.10-0.30 carbon, 0.50-0.75 silicon, 0.5-0.6 manganese, 6.0-12.0 nickel, 14.0-20.0 chromium. The steel has the following properties ; ultimate strength 55-80 kg/mm² ; elastic limit 20-38 kg/mm² ; elongation 30-60 per cent ; Mesnager resiliency 25-32 kgm. It resists nitric acid as well as brine, soda, potash and ammonia, but is attacked by hot hydrochloric acid, sulphuric and acetic acids.

For the mining industry, the high cost of this alloy has limited its use up to the present time. However, a number of centrifugal pumps with moving parts, and casings, of austenitic steel are already being used in England and Belgium. Similarly, a high nickel-chromium steel is commonly used for turbine blades. The steel A.T.V., containing about 36 per cent nickel and 12 per cent chromium, has been used for such purposes for a number of power plants, and corrosion of the blades has been eliminated by the use of this alloy. An interesting application is the use of stainless steel in the treatment plant of potash mines. Tests on pins and links of elevators made of 18-8 chromium-nickel steel have shown very good resistance to the chlorinated alkali solutions. Despite its price, its use is justified by advantages of longer life and absence of breakdowns and accidents, which were frequent from the rapid deterioration of plain carbon steel.

Cast irons of high nickel, copper and chromium content of austenitic structure are coming into use. Their compositions lie within these limits : 2.7-3.2 carbon, 1.5-3.0 silicon, 1.0-1.5 manganese, 0.2 phosphorus, 13-15 nickel, 5-7 copper, 2-4 chromium. Such irons are readily machinable and have excellent mechanical properties. They are already used in the construction of mine pumps, in which the body, moving parts and diffusers are made of this metal.

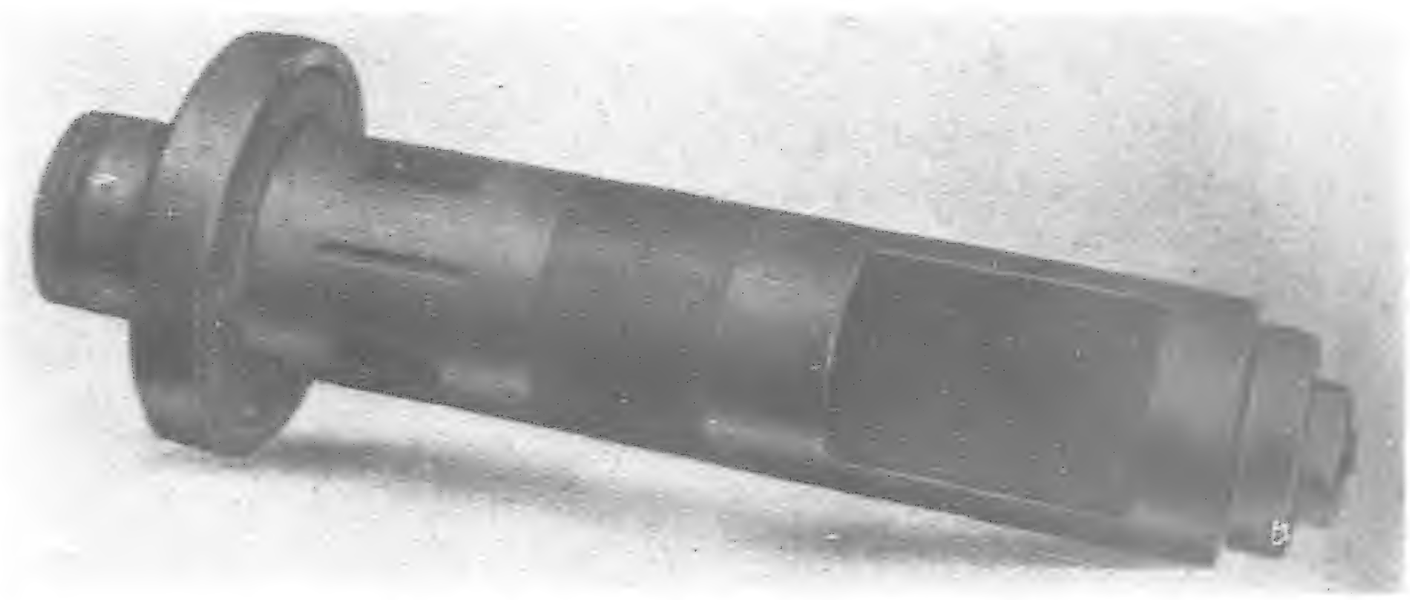


Fig. 17.—Central Valve of Superhaul

Monel Metal

Monel metal is the best known of the copper alloys with high nickel content ; its average composition is about 67 nickel, 28 copper, 3.5 iron, 0.75 silicon, 0.5 manganese. The mechanical properties of a good cast monel metal are as follows : ultimate strength 30 kg/mm² ; elastic limit 20 kg/mm² ; elongation 10 per cent in 50 mm.

Monel metal castings are used largely in the United States for steam distribution parts, and in the chemical industry on account of their corrosion-resistance, high mechanical properties and non-brittleness.

In England monel metal is used for gate valves, and in collieries for pumping acid water where it advantageously replaces bronze. Pump shafts are made of drawn monel metal with an elastic limit of 60 kg/mm², and a good coefficient of friction. Monel metal is also used in the construction of vibrating screens and sieves for washeries. In a Lancashire colliery it has been found advantageous to replace the steel and bronze screens which lasted only a few months, with screens of monel metal which seem to be able to last indefinitely despite the corrosive

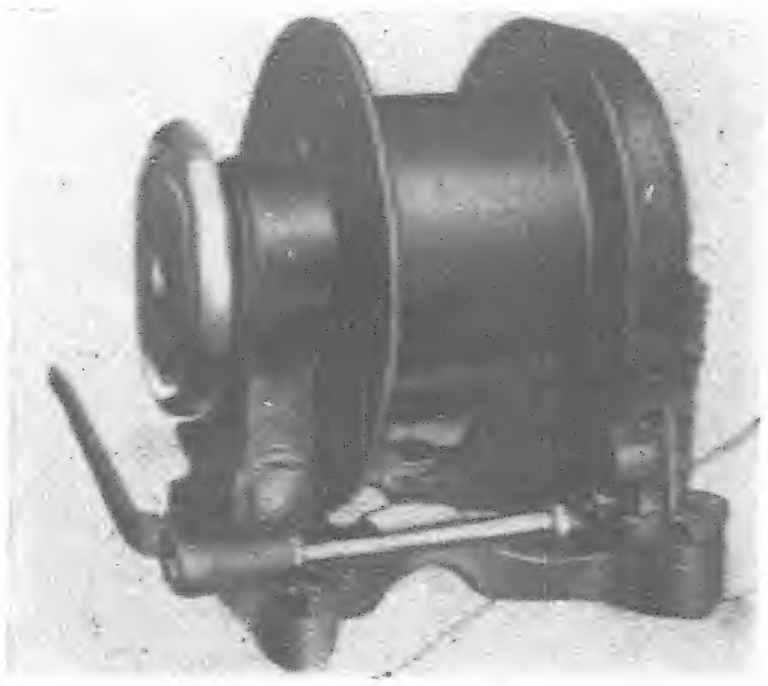


Fig. 18.—Superhaul

Fig. 19.—The Eimco-Finlay Loader in operation

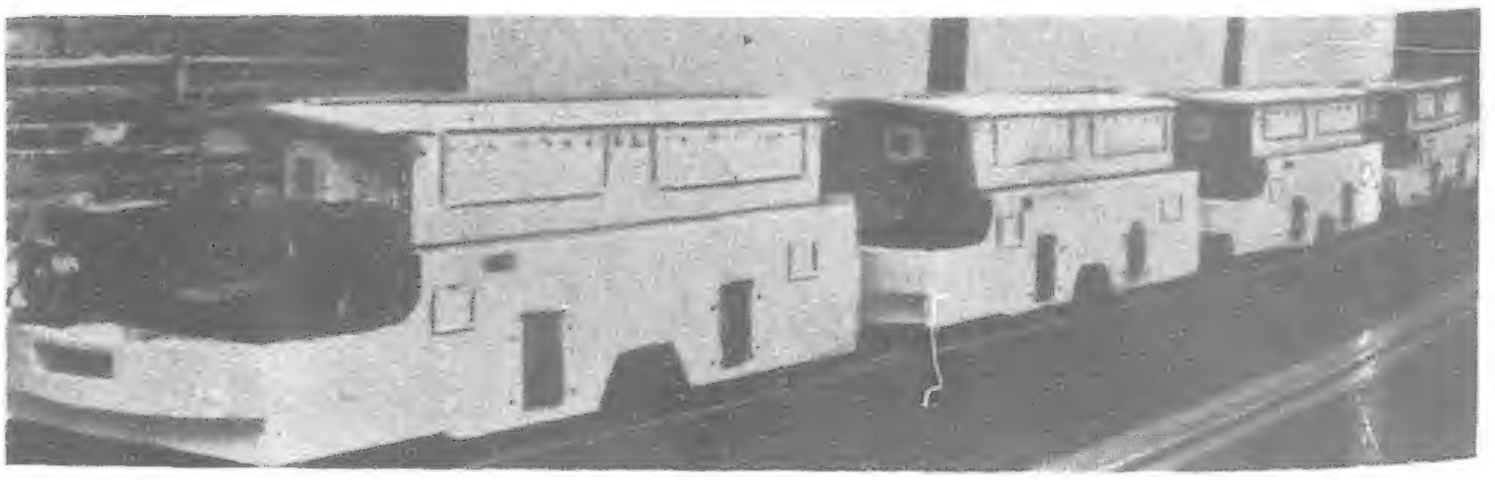


Fig. 20.—Goodman Battery Locomotives used for Nickel Ore haulage

action of acid mine water with the coal (Fig. 7-A, Fig. 7-B.) Similar results are reported from the United States and Belgium, where the metal is made up into plain or perforated sheets for washeries. Another use is in the construction of turbine blades and other parts that come in contact with steam contaminated with acid vapors. It is even used for cables where corrosion action is particularly strong, as well as for bolts, rivets, pins, etc.

Nickel Alloys in Mining Tools

In the manufacture of rock drills, a considerable use is already being made of nickel and nickel-chromium steels for important parts of the machines. For example, a well-known manufacturer uses a two per cent nickel steel, case-hardened and oil quenched, for the cylinder shaft and guides; a four per cent nickel-chromium self hardening steel for the distribution parts; and a four per cent nickel-chromium steel for the drill holder (Fig. 8). In England, the internationally known Holman Bros. Ltd. of Camborne, attribute the success of their pneumatic drills for the last ten years to an extensive use of nickel steels; various steels of 3-5 per cent nickel content constitute, for instance, 80 per cent of the total weight of the Holman machines (Fig. 9). Similarly, in the hammer drills of a well-known French manufacturer, 90 per cent of the pieces are made of nickel steel, usually 3.5 per cent nickel quenched in oil or three per cent nickel case-hardened and quenched. For the pistons of concrete breakers, which must be especially hard and resistant, this company uses a case-hardened steel of complex composition with high nickel content such as 0.085 C., 0.31 silicon, 0.39 manganese, 0.032 sulphur, 0.012 phosphorus, 4.91 nickel, 0.53 chromium. Manufacturers of coal cutting machines are using nickel-chromium steels of various compositions for chains, gears, casings, etc. The well-known "Miracle" shovel of Hardypick, Ltd., of Sheffield, England, claimed to be unbreakable and unbendable, with great resistance to abrasion, employs a forged steel with this composition:—0.40 carbon, 0.35 silicon, 0.63 manganese, 0.025 sulphur, 0.023 phosphorus, 1.28 nickel, 0.8 chromium (Figs. 10 and 11).

Fig. 21.—Miners' Lamps operated by Storage Batteries

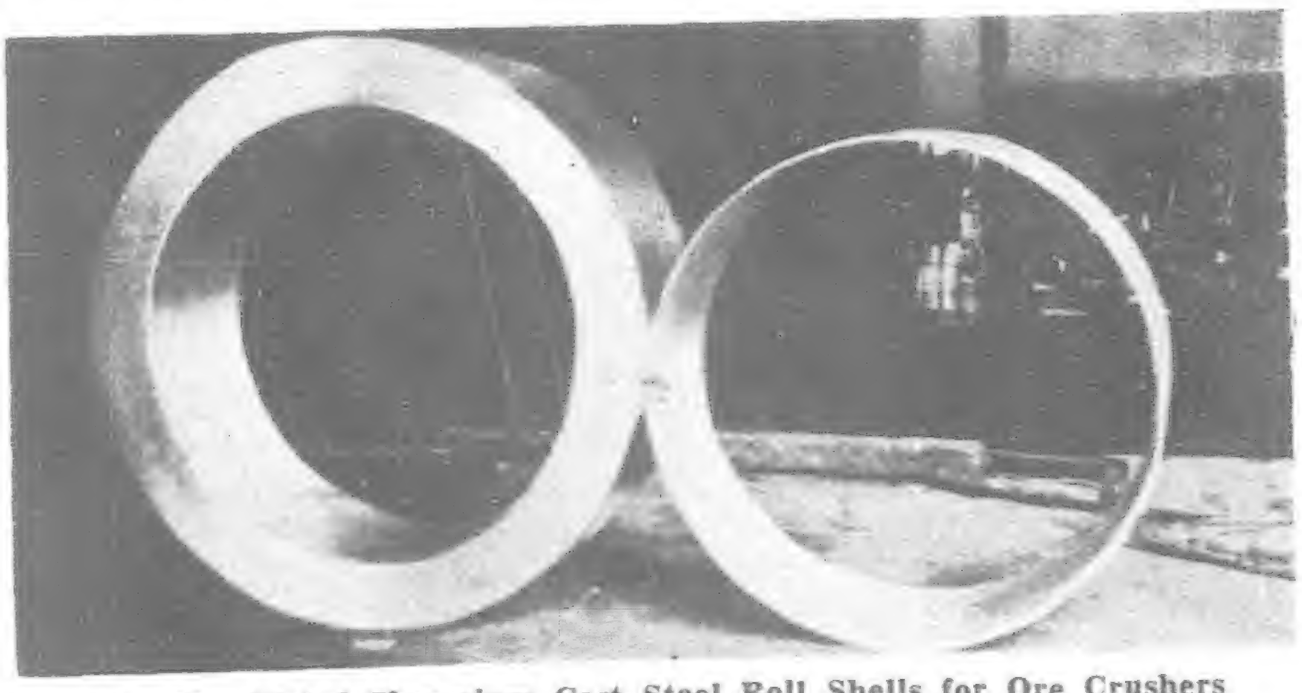


Fig. 22.—Nickel-Chromium Cast Steel Roll Shells for Ore Crushers

Material Specification for Rock Drills

The nature of the service which rock drills are called upon to perform necessitates the use of exceptionally strong and tough materials. If any part is defective, the heavy and rapid blows struck by the piston of the drill soon cause extensive damage. Absolute soundness is ensured in all Holman drills by using solid drop forgings or solid bars for all parts, and by taking full advantage of the physical and mechanical properties of nickel alloy steels (Fig. 12).

The total weight of material required to make the drill is about 220 kg. (finished weight 75 kg.), several different alloy steels being used. About 80 per cent of the rough weight consists of steel with nickel content varying from three to five per cent.

The weights of the blanks and finished parts illustrated are:—

	Rough Weight	Finished Weight
Drop Forgings:	kg.	kg.
Cylinder	41.5	14
Cradle	22.2	14.5
Back Head ..	4.3	2.7
Front Head ..	14.5	4.7
Bar Steel:		
Piston	18	3.4
Chuck	13	3.9

Material Specification for H.S.B. Air Compressor

As is the case with the rock drills, nickel alloys play an important part in ensuring reliability under the severe service conditions encountered (Fig. 13). The following parts are made from nickel-bearing steels:

Floating Rings—air-hardening nickel-chromium steel containing 3.75-4.5 per cent nickel (Fig. 14).

Gudgeon Pine—5 per cent nickel steel.

Outer Races of Gudgeon Pin Bearings: Nickel-chromium case-hardening steel containing 3-3.75 per cent nickel.

Nickel cast iron containing approximately one per cent of nickel is used for the cylinder body and other castings. (Fig. 15 and 16).

Nickel Alloy Steel Castings Help Achieve Strong and Compact Design

Western U.S. Mining engineers and mine operators have for some time realized the need for a self-propelled track-mounted shovel which would be strong enough to handle the loading of rock and muck in mine drifts, and at the same time be small enough to take into the standard cages without dismantling. (Fig. 19).

Operating in one of the largest lead-silver mines, one of the loaders has loaded 60 to 80 cars in two and a half to three hours with one operator and two trammers. In another mine where this machine is in use, the actual loading time, with 0.45 cubic meter cars, averaged less than one minute per car.

This loader uses compressed air power for the various operations of crowding, dumping and hoisting. The traction required to push the shovel into the muck piles is obtained by using on the truck heavy solid wheels of cast nickel-chromium steel, and cast spacer blocks of the same material (Typical analysis: Carbon 0.42 per cent, manganese 0.68 per cent, nickel 2.04 per cent, chromium 1.00 per cent). To assure freedom from breakage in the necessarily hard service underground, 1.5 per cent nickel steel is used for the main deck castings and similar parts (Typical analysis: Carbon 0.27 per

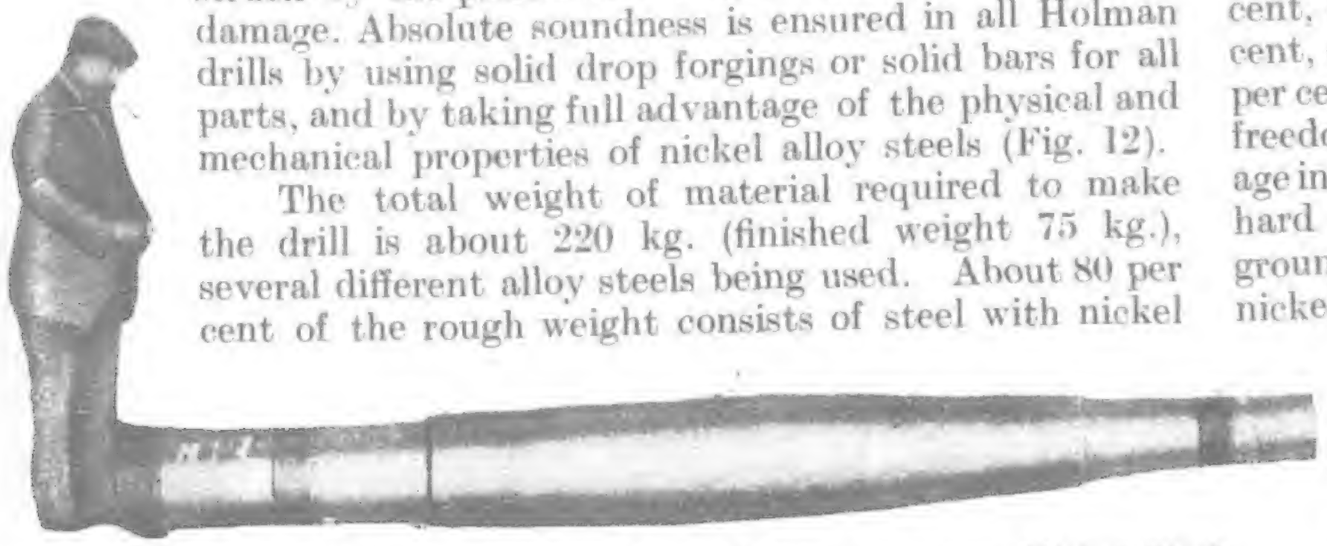


Fig. 24.—Shaft for Ore Crusher, forged from 3 per cent Nickel Steel

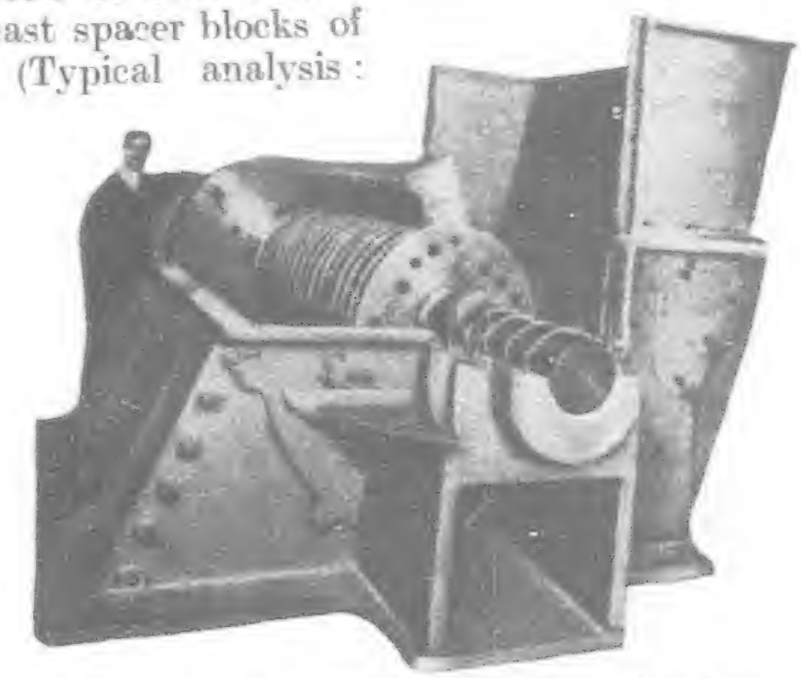


Fig. 23.—"Mammoth" Crusher showing Main Shaft forged from Nickel Steel

cent, manganese 0.68 per cent, nickel 1.60 per cent).

Some other applications of nickel-chromium steels for mine equipment are noteworthy. In England a 1.5 per cent nickel, one per cent chromium steel of high elastic limit is commonly used for the gears of underground conveyors, loaders and scrapers. In one instance the gears of a scraper hoist are made of semi-hard nickel-chromium steel, heat-treated for an ultimate strength of 95 to 105 kg/mm². The Link Belt Company, in America, has made its conveying chains entirely of nickel-chromium steel. Not only in gears, but for shafts, drums and other parts of compressed air hoists are nickel-chromium steels specified by many manufacturers to save weight and increase the strength factor. The same can be said for the shafts and gears of rock crushers and even coal breakers. With air compressors, exceptionally good results have been obtained by using 3.5 per cent nickel steel for eliminating breakage in the valves.

In the construction of vibrating screens the use of nickel-chromium steels permits an increase in the screening surface by appreciably reducing the weight of the apparatus, with no increase in the power consumption.

All the gears, pins and buckets of the Ruston-Bucyrus steam shovels are made of nickel-chromium steels. The pins and links of sand dredge buckets are made of the same material.

Nickel steel is also used in the construction of briquette presses. In a series of tests it has been demonstrated that the life of the balance shafts made of two per cent nickel steel, heat-treated, was three times as long as that of similar ones made of ordinary semi-hard carbon steel.

Storage Batteries

Nickel finds a great field of application in the construction of alkaline storage batteries in the form of nickel-iron or nickel-cadmium elements. These storage batteries keep the load longer than the lead batteries, and in addition, have the great advantage of longer life and less weight. In the mines they are used extensively for locomotives and for electric lamps. For the latter purpose, their light weight is particularly appreciated, and their use has been widely extended. In the French collieries alone there are more than 90,000 of such lamps employed. The capacity of the battery now reaches 17 ampere-hours, and the duration of the electrodes is between four and five years.

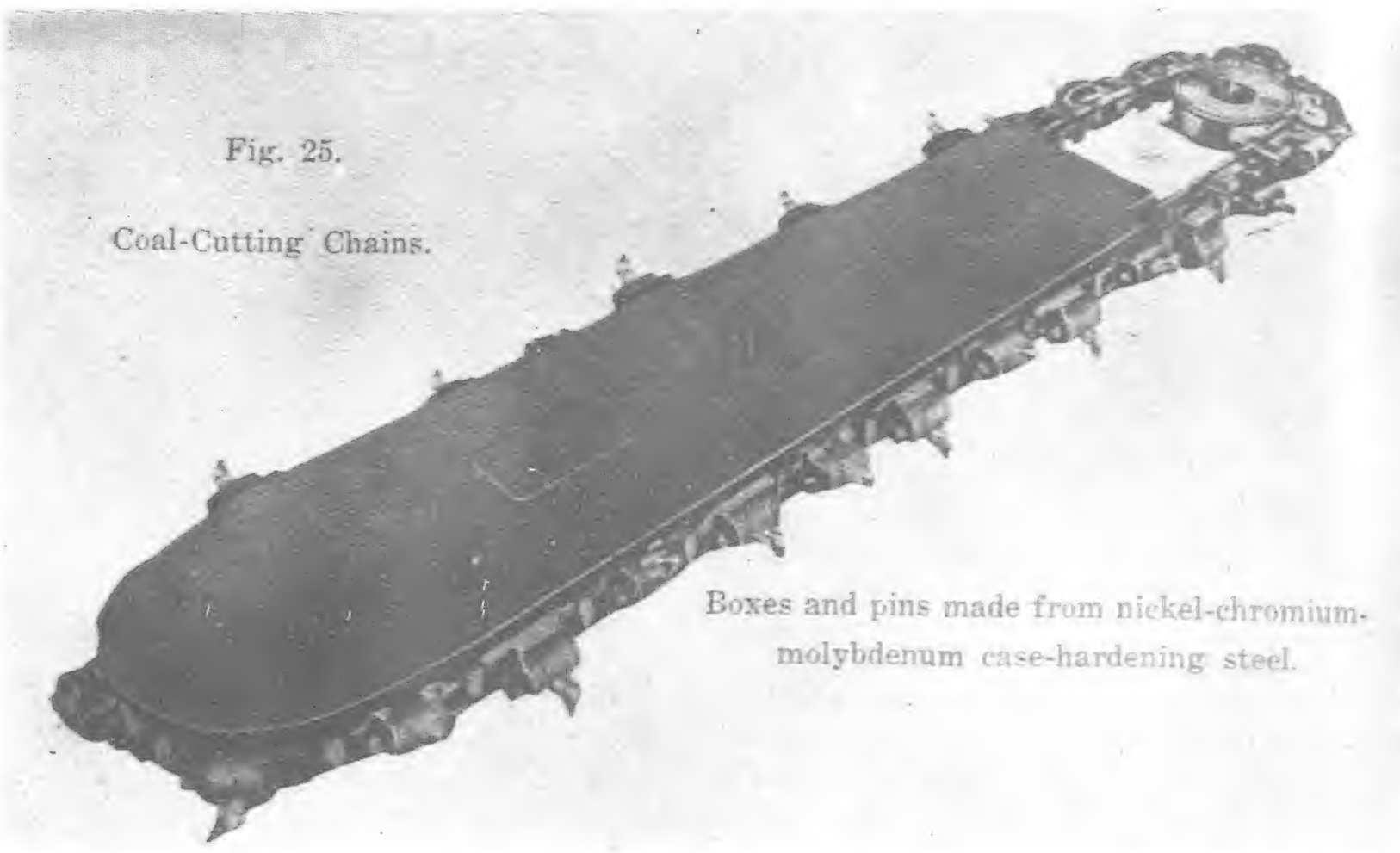


Fig. 25.

Coal-Cutting Chains.

Boxes and pins made from nickel-chromium-molybdenum case-hardening steel.

Fig. 25.—Coal-Cutting Chains. Boxes and Pins made from Nickel-Chromium-Molybdenum Case-Hardening Steel

Battery Locomotives Provide Dependable Ore Haulage

At the 840 m. level in the Frood Nickel Mine in Sudbury, Canada, the main shaft is 650 m. away from the ore body. On the main haulage levels 6,000 kg. storage battery locomotives gather the ore cars from the side drifts and make up trains which are hauled by large trolley locomotives through the length of the main footwall drift and thence to the ore dumps near the main shaft. On intermediate levels storage battery locomotives are used for both ore and waste haulage. These storage battery locomotives, are equipped throughout with gears and axles of 3.5 per cent nickel steel.

The Materials

Mine locomotives must be powerful, and able to transport heavy loads, at the same time being as light in weight as possible, the question of materials is of primary importance. Also, these locomotives are subject necessarily to severe abuse in service, and must be able to perform over long periods with breakage or failure of parts reduced to a minimum. Therefore nickel alloy steels are used for the more highly stressed parts (Fig. 20).

On these locomotives the worms are of S.A.E. 2315, 3.5 per cent nickel steel, carburized and heat-treated to procure a tough core in addition to a wear-resistance case.

For all armature shafts and transmission shafts S.A.E. 2340, another 3.5 per cent nickel steel, oil hardened, is employed. These materials have always given excellent service, and are responsible in some measure for the highly satisfactory performance which these storage battery locomotives have given in this and similar heavy duty applications.

	Capacities			*Mean*	*Weight*	*Watt-*	*Watt-*	*Price*
	Ampere-hour	*Watt-hour*	*Litre*	*voltage volt*	*kg.*	*hour per litre*	*hour per kg.*	*%*
Lead Battery	180	346	17.9	1.92	49	19.3	7.1	100
Nickel Battery	150	180	2.98	1.20	6.3	60.6	28.6	157

A comparison of the nickel-iron-alkaline battery with the lead oxide-acid battery is given above :

In manufacturing the nickel-iron-alkaline storage battery, tissue-thin flakes of pure nickel, and nickel hydrate (which becomes an oxide later during the "forming" process) are loaded into the positive tubes in alternate layers, under a high pressure.

A considerable number of nickel storage batteries are in use in the mines of Japan (Fig. 21).

Nickel Steels in Mining Equipment

In the 1,880×3,658 mm. Marcy rod mills at the INCO smelters, in Copper Cliff, Ontario, Canada, a steel containing:

Carbon	*Manganese*	*Nickel*	*Chromium*	*Molybdenum*
0.60-0.70	0.60-0.80	1.75-2.25	0.75-0.90	0.40-0.50

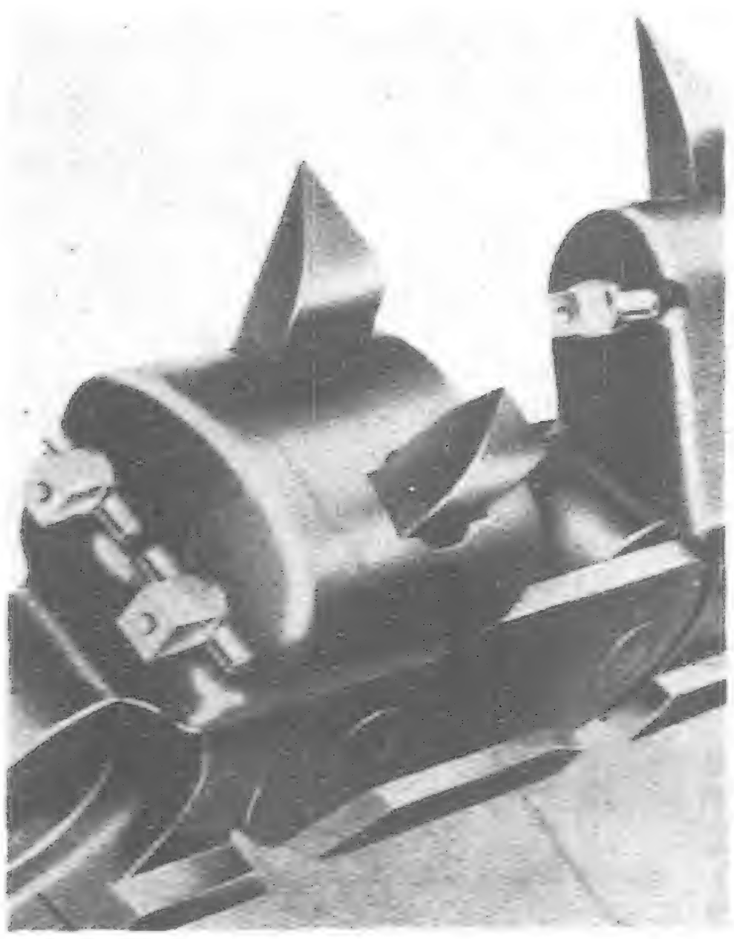


Fig. 26.—Section of Coal Cutting Chain

Fig. 27.—300 ton Traylor Gyratory Crusher

produced six per cent more tonnage than the plain austenitic manganese steel liners formerly used. The liners were heat-treated by normalizing at 900°C, followed by drawing at approximately 370°C. According to a report received from the smelter, the nickel-chromium-molybdenum steel liners ground 242,230,000 kg. of ore as compared with 228,860,000 kg. formerly obtained with the manganese steel.

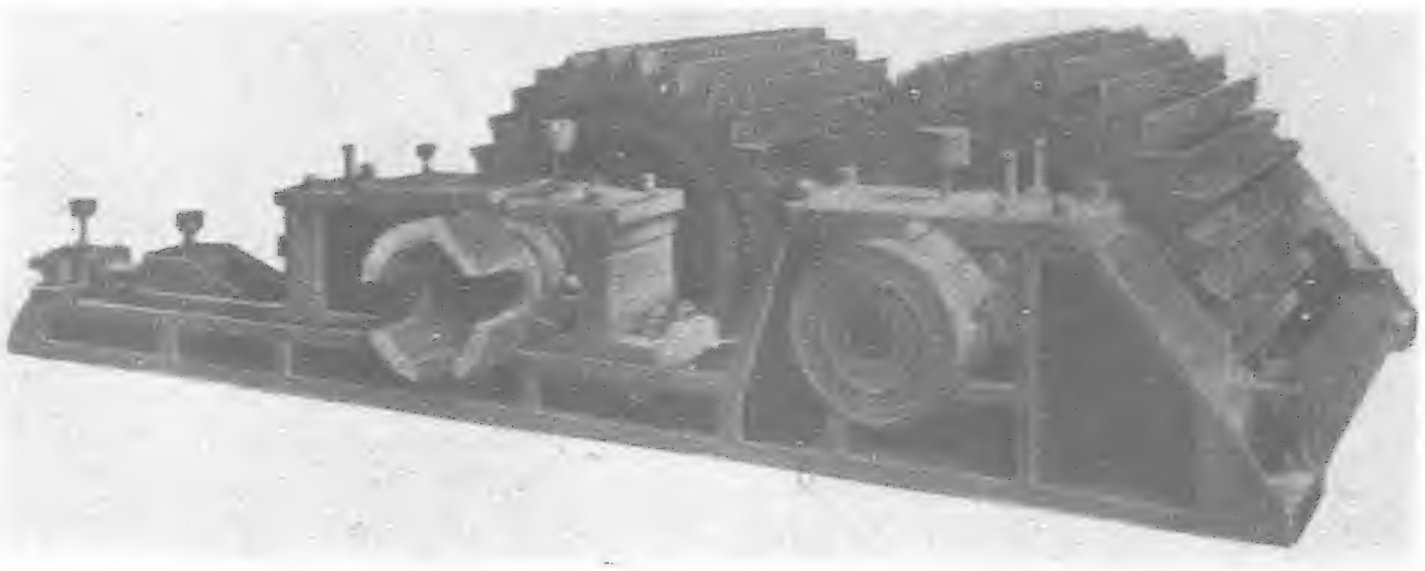


Fig. 28.—Robins Adjustable Coke Crusher with Ni-Hard Iron Roll Segments

Crusher Roll Shells

A cast steel containing approximately 0.70 carbon, 2.50 nickel, 0.50 chromium, normalized and drawn to a hardness of 300 BHN, is used successfully for this service.

The illustration Fig. 22 shows, at the left, one of several roll shells for ore crushers used by a prominent Western U.S. Copper Mining Company. The finished dimensions are 1,950 mm. diameter, 610 mm. face width, and 230 mm. wall thickness.

The thin ring at the right is one of the same shells just after removal from service. During its period of operation this worn out shell crushed a total of 300,877,000 kg. of ore which is 20 per cent more than the best record made by the forged shell previously used. Although it is worn down to 38 mm. thickness, note that the wear is comparatively uniform, and there was no crack or incipient breakage evident, which would occur with ordinary roll shell material long before being worn down to this extent.

The cast steel used in these shells is a high carbon nickel-chromium composition. The castings are normalized and tempered to show a Brinell hardness of approximately 300. In addition to the combination of hardness and toughness afforded by the alloy content, it is believed by the producers that the cast alloy steel rolls grip the ore better than forged rolls owing to the peculiar orientation of the crystalline structure, and hence give superior grinding efficiency and less wear of the rolls from slipping.

Crusher Shafts

S.A.E. 3135, nickel-chromium steel is used for small and medium sized shafts.

As crushers must work in all sections of the country and handle all types of rock, toughness is an important consideration, as shock loads are unavoidable in the service to which these crushers are subjected. Accordingly, an S.A.E. 3135 nickel-chromium steel rolled shaft drop forged and heat-treated is used for these shafts. These shafts have been used as standard for the last four or five years, during which period no reports of breakage have been received (Fig. 23).

Mining companies operating in cold climates often experience trouble through the breakage of important parts subjected to impact or shock at subzero temperatures. Several of the Canadian mining companies are now using low and medium carbon two per cent nickel steels to overcome this difficulty.

Another steel which is being used for miscellaneous constructional castings of light and medium sections, such as highly stressed members of ore cars, excavating machinery, tractors, etc., is a pearlitic nickel-manganese steel.

Coal Cutting Machines

There is a good deal of interest in the use of nickel steels for coal cutting machines. In the most successful types of machines either high tensile direct hardening 1.5 per cent nickel, 0.7 per cent chromium steel, or case-hardening four per cent nickel-chromium steel, is being used for such parts as chains, boxes, etc. For the gears, air-hardening four per cent nickel-chromium steel is being used as well as oil-hardening high tensile 1.5 per cent nickel, one per cent chromium steel. The cutting tools are generally made from 0.5 per cent carbon steel (Figs. 25 and 26).

Conveyors and Loading Machines

For the gears, shafts, etc., of conveyors and loading machines, high tensile direct hardening 1.5 per cent nickel, one per cent chromium steel is in use.

Excavators

Messrs. Ruston-Bucyrus Ltd. of Lincoln in England use cast nickel-chromium and nickel-chromium-molybdenum alloy steels for the rack and pinions of their excavators. Similar steels are also used for the various gears, and driving sprockets in the same excavators.

Another manufacturer is using nickel five per cent case-hardening steel for excavator bucket pins.

Although outside the scope of this subject, power units, e.g. small Diesel engines, make extensive use of nickel cast iron and nickel steel. Special mention might be made in this connection of the petrol driven rock drills and other appliances manufactured in England by The Pneumatic Engineering Co., Ltd.

This engine is of minute dimensions (153 mm. high and 38 mm. cylinder bore) but is called on to work under most arduous conditions. Nickel cast iron is used throughout for the cylinders and crankcases.

The successful operation of many types of excavating machinery is dependent on the efficiency of the brake drums and clutches used to stop and start the various movements. After repeated tests covering all the available materials it has been found in Great Britain that nickel cast iron has proved superior to all rivets, from the point of view both of relatively good wearing quality and good frictional properties. A typical composition which has been adopted is as follows :—

Total Carbon ..	3.2 per cent.	Sulphur ..	0.1 per cent
Silicon	1.25 ,,	Nickel ..	1.25 ,,
Manganese ..	0.7 ,,	Chromium ..	0.5 ,,
Phosphorus ..	0.5 ,,		

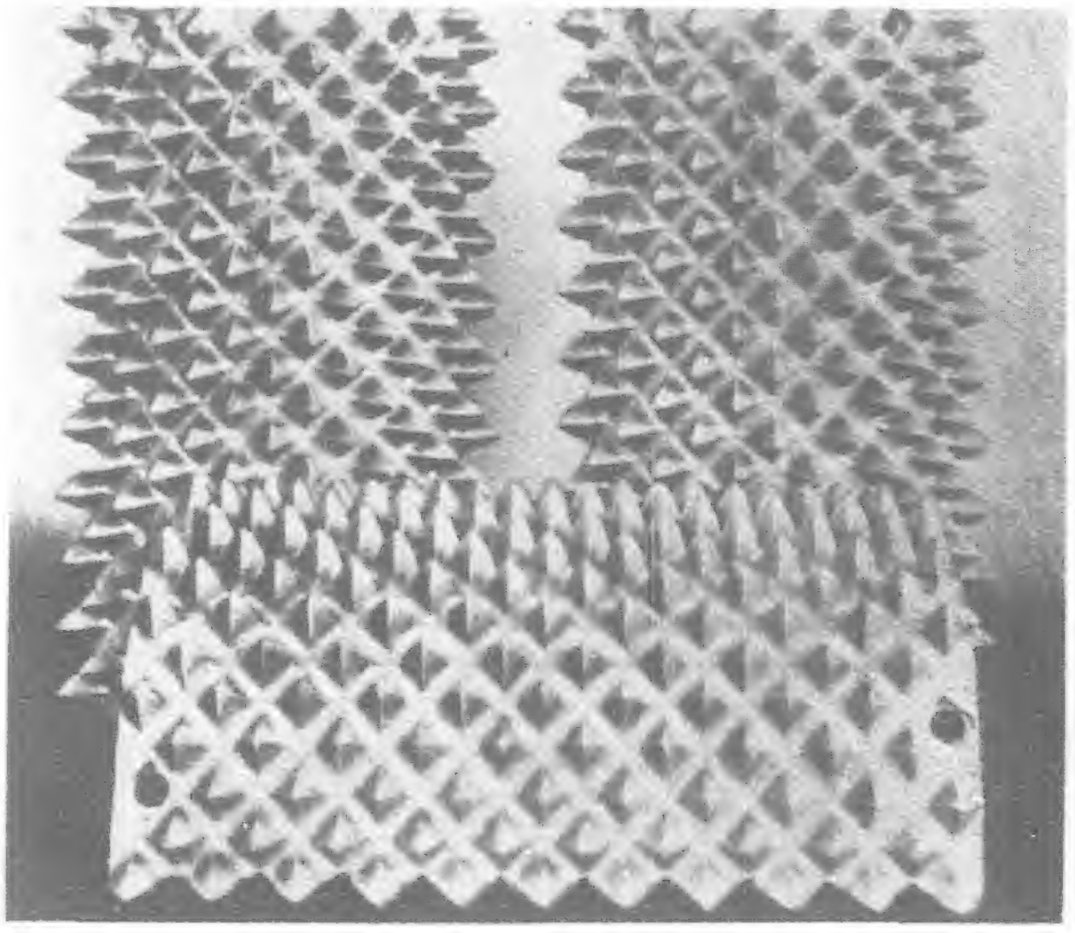


Fig. 29.—Crusher Segments made in Sand Cast Ni-Hard Iron

Nickel-Cast Irons in Mining Equipment Crusher Frames

The growing use of nickel alloy cast iron in mining machinery is exemplified by its application to the "Buldog" jaw crusher frame in the 300,000 kg. traylor gyratory crusher (Fig. 27).

In this crusher there are some individual castings weighing 45,500 kg.

The necessary strength, wear-resistance and dependability are secured by using a nickel-chromium cast iron of the following composition :

TC	2.89	2.82
Mn	0.73	1.03
Si	1.60	2.20
Ni	1.07	2.74
Cr	0.78	0.65
Transverse Breaking (kg.)	2,800	1,100
Deflection (mm.)	3.6	3.6
Brinell Hardness	321	302
Tensile Strength (kg/mm²)	29	29.5

The large gears on this crusher are made of cast steel but in many cases the small gears are made of a nickel cast iron containing 1.50 Ni with 0.75 per cent Si, with a steel scrap mixture of 60 per cent.

For milling and crushing ore and propelling slimes and tailings, Ni-Hard is widely used. This is a nickel-chromium cast iron containing 4.50 per cent nickel and 1.50 chromium (Figs. 28 and 29).

It can be produced either as a chilled or as a sand cast material, and is used for dredge pumps and coke crushers. In addition, grinder rolls 1.5 m. in diameter, 610 mm. face, and 306 mm. thick, are regularly produced in Ni-Hard, in the Joplin zinc district U.S.A., where they deliver a performance excelling hardened steels or manganese steel, at less initial cost. Tonnages run in the neighborhood of 250,000 per year. Crusher jaws, particularly the stocky short square types, averaging under 760 mm. square and running over 100 mm. in thickness are working very successfully in Ni-Hard. Several lots of Ni-Hard ball mill liners are working in mills 1.8 m. in diameter and less. Larger diameters have always been lined with steel but tests are now under way working up to 3 m. diameters. One test completed on Ni-Hard vs. forged hardened steel, showed 50 per cent greater tonnage for Ni-Hard grinding balls pulverizing a pyrrhotite rock. Sand and slime pumps deliver from 50 to 400 per cent more service than plain white iron pumps. The performance varies widely with the speed head, percentage of solids, and other operating factors. Some pulverizer and sampling mill discs are in service made of Ni-Hard, and specifications for some of these regularly insist upon a minimum of 60 Rockwell "C" hardness. The Aldrich pump with Ni-Hard plungers, is widely used in the mining field to handle cyanide slimes.

Sand cast Ni-Hard grinding plates deliver three times the service of hardened steel at half the initial cost.

Ni-Hard provides two to 12 times longer life as compared with unalloyed sand cast or chilled irons in equipment handling ore, stone, coke, coal and other abrasive agents of this nature.

Sand and sludge pump bodies and pistons, pumping mine water and sand (or concentrates) have lasted four to six times longer when made of Ni-Hard cast iron than when made of unalloyed castings.

Ni-Hard Characteristics

Ni-Hard cast iron can be produced either as a chilled or as a sand cast material. Chilled Ni-Hard attains 600 to 750 Brinell as against 380 to 530 for a corresponding grade of plain chilled cast iron. Sand cast Ni-Hard possesses a solid white structure with Brinell hardness ranging from 475 to 625.

Various applications of this iron are included in the list of materials recommended for mining service at the end of this paper.

Winding Gear

In virtue of its greater strength, nickel cast iron has been employed for the drums used in winding and haulage gear. The use of an iron of this type offers advantages not only of greater reliability, but also frequently enables substantial reductions in weight to be effected, this in turn leading to a saving in power in hoist machinery. Mine hoist drums up to 25,000 kg. in weight have been made in nickel cast iron in England showing a tensile strength of 28.5 to 34.5 kg/mm^2.

Austenitic cast iron is also used for the castings and impellers of pumps handling corrosive mine waters. One of the large pump makers has supplied a number of pumps in austenitic cast iron which are giving satisfactory service with mine waters showing various degrees of acidity and containing both ferric sulphate and free sulphuric acid.

The Output of Tungsten

THE monopoly for tungsten ore which the Canton Government established after seizing the political power has now been in operation for a year, so that it is a favorable time to review the industry. Tungsten is an element of the chronium group found in certain minerals, as wolfram and scheelite, and isolated as a heavy steel grey metal which is very hard and infusible. When alloyed in small quantities with steel it greatly increases its hardness.

Tungsten belongs to the group of commodities which are very sensitive to business changes. Its consumption declined precipitously during the depression, and as it was evidently disproportionate to the productive capacity, the world market price fell very heavily. The situation which the monopoly met, therefore, did not differ from the problems facing other raw material industries. But the task of the Chinese Administration was facilitated by several circumstances particular to the tungsten trade.

Tungsten deposits are exploited in a few countries only. Even during the war, when very large quantities were absorbed, the bulk of supplies came from no more than six countries. In 1918 world production amounted to 32,000 tons. In 1929, the best year after the war, production was 16,000 tons, of which China supplied 10,000 tons, Burma 1,600 tons, Bolivia 1,500 tons. U.S.A. 750 tons, Malaya 500 tons and Portugal 350 tons.

China alone was able to maintain the war level, owing to low labor costs, the favorable geographical distribution of the deposits, good transport conditions and climatic advantages.

These circumstances give the Chinese production a good start in international competition. It has been calculated that most of the non-Chinese producers are unable to work profitably below a market price of 25s. To-day, owing to currency depreciation and other causes, the figure may be estimated at about 30s. Actually the output of tungsten ore in China did not suffer less than that of other countries during the depression, though the price fell to 10s.

In 1932 China supplied but 2,100 tons of the world demand of 6,000 tons, thus ranging behind Burma with 2,200 tons. But when the steel production again advanced, the key position of the Chinese production became evident once more. In 1933 China produced 5,500 tons out of a total world output of 14,000 tons, while Burma contributed 4,300 tons, Bolivia 1,350 tons, Malaya 1,300 tons, U.S.A. 800 tons and Portugal 350 tons.

This year the world consumption of tungsten ore shows a further rise. The United States imported 1,395,938 lbs tungsten concentrates in the first seven months, as against 1,230,608 lbs in the whole of 1933, though the home production increased by the reopening of the mines of the Wolf Tongue Mining Company, in Boulder (Colorado), and by additions to the production of other mining companies.

The United Kingdom retained in the first nine months of 1934 tungsten ore imports of 3,887 tons, as against 2,116 tons in the corresponding period last year.

These figures illustrate the trend of world consumption to a certain extent and account for the further rise of the world market price. It rose from 27s at the beginning of this year to so high a level that the official monopoly quotation was raised to 50s at the end of May. During the following months, the world market price declined, but the cheaper offers mostly originated from Chinese second-hand holders and foreign sources. The monopoly sales were drastically reduced, because the Chinese authorities were aiming at the maintenance of the price level reached rather than at the expansion of sales.

The chief reason for the attitude of the monopoly administration is afforded by the movements and potentialities of production in other countries. The rise in world output during the last year does not concern the producers of pure tungsten ore as much as the tin-tungsten mines. The improvement of the tin price and the increase in tin quotas also brought a higher production of tungsten concentrates, but apparently the stimulus from this side will cease, if the tin quotas remain stationary or are reduced.

New projects (which are not confined to Portugal, though there conditions are said to be most favorable), together with the greater supplies from tin-tungsten mines, will result in a considerable increase of world production. This year is likely to show the highest output since the war.

On the other hand, the use of ferro-wolfram has by no means arrived at the maximum. Apart from constructive purposes ferro-wolfram finds a large outlet in armaments, and it is interesting that the naval conversations are associated with the attitude of the Chinese authorities.—*Financial Times.*

Moving a Whole Town in the Philippines to Dredge for Gold*

The River and Bay at Paracale. Beyond the river is the land which the Cocogrove Placer Syndicate plans to work for gold

In its day the town of Paracale has seen many gold booms rise and fall. It is famous as the town which provided the metal from which were fashioned a solid gold hen and a brood of chickens presented to a queen of Spain. But if present plans are carried out the Camarines Norte town will become even more unique in Philippine history. It will be the only town to be moved from one site to another in order to facilitate gold mining operations!

The Cocogrove Placer Syndicate has laid a proposition before the municipal council offering to lay out new streets a few kilometers from the present town, to light them with electricity provided free of charge, to extend the existing water system to the new site, to give the municipality ample land for a presidencia, a public park and two school buildings, to provide present property holders with parcels of land at least as large as they now own and to give them the funds with which to build homes at least as good as their present ones, and finally to return to the property owners their present parcels of land with registered deeds for each parcel, when the dredging operations have been completed.

Syndicate's Objective

The reason for this offer of the Cocogrove Placer Syndicate is not, of course, wholly altruistic, although syndicate officials say the proposed town site is higher, drier and larger than the present one.

Briefly, the syndicate owns a large piece of land north-west of Paracale, which it wishes to mine by placer methods. Two routes may be followed in getting the dredges and other equipment to the place where the gold is believed to be. First, by way of the bay; second by way of the river, which would mean dredging a channel directly through the present town site.

Above: Part of the town of Paracale, which the Cocogrove Placer Syndicate is offering to move to a new location. Below: The new district which the Syndicate has prepared for the town

Syndicate officials believe the second method is the best, especially as the river would afford protection for the dredges during the typhoon season. For that reason they have made the offer of literally moving the town to the new location.

Whether the town will accept the proposition remains to be seen. Several mass meetings have been held at which speakers appeared to object to the removal. On the other hand, town and provincial officials are said to support the change, on the ground that it will benefit the people and that the dredging operations will stimulate business in the town.

Philippines Free Press

Chinese State Workshop

Among recent contract and tender advertisements is one announcing that the Chinese Government Purchasing Commission in London is prepared to receive tenders from British manufacturers for the supply of machinery for the equipment of an engineering workshop on a site not far from Shanghai.

The workshop will be erected by the Chinese Government, and will be run, it is understood, as a State concern. It will be used to produce iron and steel tubes and a variety of spare parts of machinery for commercial use. As an engineering workshop it will be industrially complementary to an iron and steel works at Hankow, in which the semi-Government and commercial interests are concerned.

Items specified in the invitation to tender include foundry equipment, plant for manufacturing cast-iron pipes up to 20-in. diameter, air and electric furnaces, and a variety of processing machinery.—*London Times.*

Japanese Industrial Developments

The Japan Salvage Co. has been founded in Tokyo with a capital of Y.1,500,000, as the result of a merger of the Tokyo Salvage Co. and the Teikoku Salvage Co. Showa Rayon Co. has decided to erect a factory in Ibaraki Prefecture. It has also purchased a large tract of land in the same prefecture to put up another factory. The Toyama Government's Electric Department plans to erect a power station capable of generating 18,000 or 20,000 kilowatts on the Wada River. Incidental to the enterprise, the company will construct a reservoir, having a depth of 296-ft., at a cost of Y.300,000. The Sumitomo Aluminium Co. has decided to undertake a new method of manufacturing alumina, as well as superphosphorites. Japan Sugar, it is said, intends to co-operate.

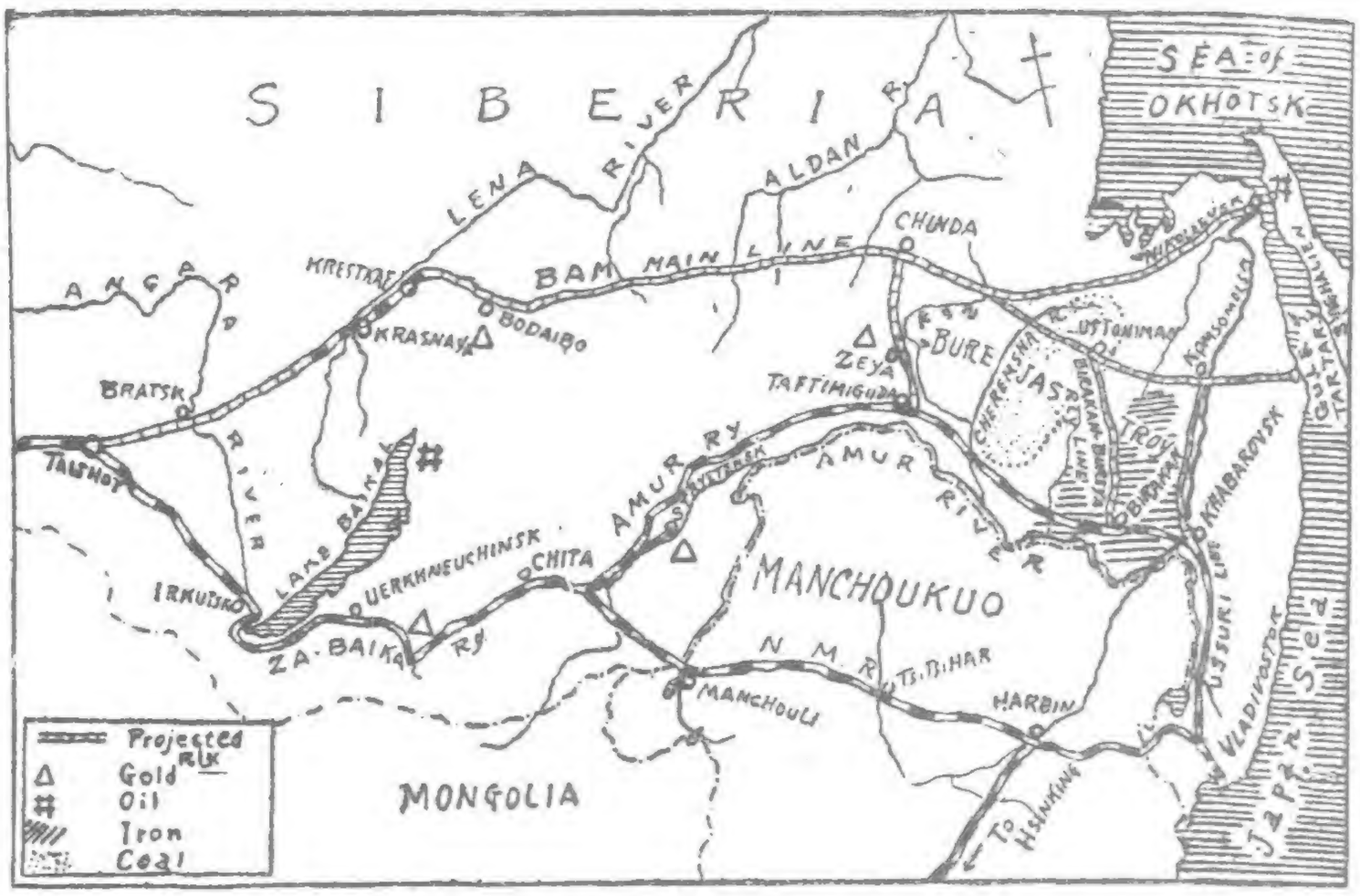
A company to exclusively manufacture 15,000 tons of kraft pulp annually has been mooted by Mr. Keizaburo Sumiya, president of the Takasaki Cellophane Co. The proposed concern will be established in Korea with a capital of Y.5,000,000.

Soviets Commence Giant Industrial Plants in Siberia*

FOLLOWING an earlier report in these columns of extensive railway building activity in Sovietland where a double-tracked line is being projected between Petrosky and Urga via Kiakhta, comes another report of even greater Soviet effort extensively to industrialize the hitherto snow-bound barren stretches of Siberia.

In the first five year industrial program, Soviet Russia paid greater attention to industrial matters in European Russia, while in the second five year plan matters in the Russian Far East form a center of attention.

The salient features in the second program comprise the building of the BAM railway (Baikal-Amurskaya-Magistraria line), the exploitation of coal and iron mines in the Burejastroy district and the mining of petrol in the Ural district.



Map Illustrating the Renewed Soviet Enterprise in Siberia

Siberia which covers a vast territory in the eastern hemisphere and which was a lonely area for political and other exiles is being transformed into a promising industrial center in the world.

The traveller pays an honest eulogy of admiration to the greatness of Soviet Russia with which he has been impressed in his recent travels in Siberia, believing that the industrial development of Siberia will contribute a great deal towards material civilization in the world.

1,800 Kilometers Long

The following is a contribution addressed to *The Manchuria Daily News* by a traveller who is now in Harbin :—

The BAM railway line is 1,800 kilometers in total distance. The main line of the railway branches off at Taishot on the Siberian railway and runs eastwards practically in parallel with the trans-Baikal line crossing the Zeya and the Cheremsha rivers. This main line traverses Burejastroy where an immense hoard of coal awaiting exploitation and Ustoniman in the minor Hsingan range where a vast wealth of iron lies underground. It goes farther east and reaches Komsolsk on the lower reaches of the Amur. The new town of Komsolsk has a population of 20,000 people at present. An extensive shipbuilding yard is under construction, for which the new town is famous. The line runs farther east till it reaches Soviet Bay, formerly the Bay of Imperatorskaya on the Tartar straits.

Surveys of the route were finished some time ago and the construction headquarters were opened at Irkutsk. An American expert was then engaged as chief engineer under whom a construction committee was appointed for each construction section.

The Bustle

Workers organized themselves into forces of "storm troops." Tens of thousands of Soviet exiles were practically forced to help in railway construction under the direction of storm troops. When the extensive preparations were finished construction work was commenced.

Freight cars on the Siberian railway had to transport large hordes of laborers and provisions for them. All available spare locomotives were called out to undertake the job. Then, in the limitless ice fields of Siberia, towns with rows of shacks loomed up here and there. Motor tractors, saw mills and other modern vehicles were set into motion. Noises of modern civilization began to be heard on all hands.

Meantime, the Soviet government abolished the tax on agricultural pursuits in Siberia with a view to encouraging emigration there.

Trials and Tribulation

The construction of the BAM railway once met with serious difficulty and work had to be discontinued for a time, for in the first five year program, the Soviet government was partial to the development of industries and deplorably neglected the development of agriculture, resulting in an agricultural panic and an acute famine overtook the Soviet territory.

The Soviet tenacity of purpose was not discouraged on that account and construction work was resumed with renewed efforts. Construction of the railway line is being expedited in good earnest by Soviet authorities who propose to finish it by the end of this year which is the last year of the second five year plan. Thus far, the section between Kreslovkaya, Orului, Gorovkha, Bodouchesnaya, Reech, Holishalnaya and Kresnaya has been finished. The distance between two railway stations is from 20 to 30 versts.

Connecting Lines

A connecting line of a total distance of 180 kilometers is now under construction between China on the BAM line and Taftminguda on the Ussuri line. A big force of 13,000 laborers are at work day and night.

Another branch line connecting Komsomolsk with Habarovsk, about 340 kilometers in distance, has been practically finished. Sappers and transport soldiers belonging to the Red Guards in Nikolaievsk participated in the building of the branch.

The construction work on the main line was commenced in October 1924, at the junction of Taishot over a distance of 300 kilometers eastward. The construction headquarters at Irkutsk is in touch with the construction committees on the ground by means of airplanes. Timber required for construction is brought by tractors from forests on the upper reaches of the Yenisei. Work was also commenced at the western terminus of the railway and at a midway point on the Zeya river.

Burejastroy's Future

Burejastroy deserves special mention when the BAM railway is handled. The total hoard of coal contained in mines at Bureya is estimated at 150,000,000, while a prospectus of iron in the southern range of Minor Hingan is placed at 415,000,000 tons.

Burejastroy, a center of heavy industry, is looming up in a district between the eastern parts of the BAM and the Ussuri line. The development of Burejastroy may yet amaze the world as a new wonder in the Far East. It will not be in the distant future that ice-bound Siberia will boast of extensive equipments and installations along the most up-to-date pattern.

The richest center of iron in the southern range of the Minor Hingan mountains is Birakan on the Ussuri line and the center of coal is Ustoniman on the BAM, due north of Birakan. To connect the two centers, a railway line of the total distance of 430 kilometers

(Continued on page 237)

**The Manchurian Month*

Gold Production in the U.S.S.R.*

ONE of the major questions in connection with the world's gold production to-day is the determination of the real production of gold by the Soviet States. This uncertainty has been greatly increased by the fact that from the year 1927-1928 up to 1932 production statistics were entirely suspended. There can be no doubt that the Russian gold production has increased largely, but the magnitude of the claims made for it, unsupported by detailed statistics, have caused all these suggestions of percentage increases to be accepted with very great reserve. It is not for us to advise the Soviet Government, nor do we imagine that they would allow themselves to be influenced by any outside opinion regarding the wisdom of their policy, but in view of the reports which we shall hope to publish in the present and succeeding issues of the Journal, there can be no doubt that they are making a big gold production a very prominent feature of their development policy. Obviously, Russia requires purchasing power abroad, and the present gold hunger and record prices render the gold industry the most effective means of purchasing the necessary foreign exchange. Capital for development is urgent for the Soviets, and under present conditions one can hardly look for foreign loans to be available for Russia. It would, we believe, be very much in the interest of the development of their gold industry if they fell into line with the practice of all the leading gold-producing States in publishing early official statements regarding the exact quantities of gold won which, in the present era of intense centralised control, could no doubt be done with far greater completeness than in the pre-War days.

For the information which has reached us recently, we are indebted to Mr. H. N. Lawrie, the well-known United States gold statistician, who sends us translations of two articles of recent date. The first is the statement by the "Ost-Express," of Berlin (No. 87, November, 1934), and the second lengthy abstracts from a bulletin in Russian by the Economic Cabinet of Professor S. N. Prokopovitch, published in Prague, also in October last. This treatise, while not an official Soviet publication, is based almost entirely on Russian sources. The translation is made by a specialist, but beyond this Mr. Lawrie does not feel himself in a position to assume any personal responsibility for the accuracy of the matter.

The efforts of the Soviet Government, which have continued for several years, to build up the Russian gold industry have not remained without result: no other branch of Soviet industry shows in recent years so great an increase in production as the gold industry. From about 51,200 kilograms in 1931 the Russian gold production rose to about 59,000 kg. in 1932 and about 88,500 kg. in 1933. Thus the Russian gold recovery exceeded in 1933 that of both the United States (78,000 kg.) and Canada (84,000 kg.), and the Soviet Union is now in second place among the gold-producing countries of the world, immediately next to South Africa. The great increase of production in the years mentioned is to be traced to the fact that in 1933 the Party direction and the Soviet Government passed a whole series of measures for the further extension of the gold industry, and thereby put through a thorough reorganisation of the management of the gold industry, by setting up for the supervision over this branch of industry, within the organisation of the Commissariat for Heavy Industry, a special chief administration, "Glavzoloto," as well as special organisations for the protection of new enterprises in the gold and platinum industry, and for the execution of geological explorations. As a result of these various measures there has been recorded, particularly since the second half of 1933, a steady increase in the rate of production in the gold industry.

In the present year the Russian gold production has continued to increase. According to recent figures of the Chief Administration of the gold and platinum industry, "Glavzoloto," the annual production plan for 1934, which has been considerably raised over 1932, has been 90 per cent. fulfilled in the first ten months of the year. Compared to the same period in 1933, the gold production of Soviet Russia has increased by about 50 per cent. On the basis of these statements the output for the first ten months of 1934 may be estimated at some 110-115,000 kilograms. It is thus already greater than the entire output of 1933.

For 12 months the output should be about 132,000 kgs., equivalent to 4,244,000 ozs.

So far as concerns the individual gold districts, production was developed most satisfactorily this year in the Ural district. The gold-producing trust "Uralzoloto" completed the year's plan for it, which had been considerably increased over that for the previous year, by October 20, 1934. Compared to the corresponding period of 1933 production in the Ural district has risen 200 per cent. Favorable results are also reported by the "Baleizoloto," "Zapsibzoloto," "Yakutzoloto," "Primorzoloto" and "Misszoloto."

The great increase of production of the gold industry is due to the discovery of new gold deposits, an increase in the proved metal reserves in the old gold workings, and the mechanisation of mining which the Soviet Government has carried on with special intensity. While in 1928 only 20 per cent. of the gold recovered was produced by mechanical methods, in 1930 the proportion rose to 28 per cent., in 1931 to 40 per cent. in 1932 to 55 per cent., and in 1933 and 1934 to about 70 per cent. In contrast to pre-War times, when 87 per cent. of the gold mined was from gold sands, the Soviet Government has placed emphasis on the production of gold from ores. In different gold mines the ores have been prospected to a depth of 350-400 metres, even as deep as 500 m. The equipping of the gold workings with machinery has been greatly improved this year, but there is still a great shortage of equipment. The chief needs are for dredges, concentration plants, electrical equipment, transport equipment, etc. The Soviet gold industry is far from being in a position to manufacture equipment for the gold industry in sufficient quantity, but importation from abroad has been seriously reduced because of valuta difficulties. Negotiations for machinery orders for the Russian gold industry are being carried on particularly in the United States. The work of the gold industry is made very difficult by the lack of skilled men. Other drawbacks are poor organisation of labour, fluctuation in the numbers of workers, ignorant utilisation of the equipment, etc. The transportation problem also presents great difficulties, because of the fact that most of the Russian gold deposits are in districts very unfavorable for transport.

Alongside of the State enterprises, the private gold prospectors have in recent years played a considerable part in the gold production. In the interest of a rapid increase in the Russian gold output, which was evidently required by the great need, since 1931, for means of paying foreign obligations, the Party leaders and the Soviet Government issued a number of decrees, with the purpose of attracting the people to seek and recover gold in such deposits as it did not seem worth while for the Government itself to work. As a result of these measures the recovery of gold by private miners has recently greatly increased: thus, for example, in the present year the production plan for the first nine months was exceeded by 20 per cent. Here also the Ural district stands in first place: the gains of private miners have risen to almost three times the figure for the same period of last year. According to newspaper reports, that come from the individual gold districts, conditions would be even better, if the local authorities did not place so many obstacles in the way of the private miners. According to reports from the Chief Administration of the Gold Industry, the "Glavzoloto," in its own experience there have been registered during the past nine months an extraordinary number of complaints by the miners of pressure from the local authorities, particularly numerous from the sections near Sverdlovsk and Cheliabinsk.

Professor Prokopovitch's report, referred to deals in detail with various aspects of the industry, but does not cover production after 1933.

The report is as follows :—

Geographical Occurrences of Gold

In connection with the increased demands for currency that could be used in foreign trade in the U.S.S.R. there have been carried on during the last five or six years considerable operations

**The Mining Journal.*

in the reconstruction of the gold and platinum industries and in the extension of the ore reserves.

The geological exploration work in the investigation of the resources of precious metals has been carried on chiefly by the trusts "Soyuzgeorazvedka" and "Soyuzzolotorazvedka," also by the gold industry itself, the Academy of Sciences and other organisations. They have discovered a number of new and very promising gold-bearing districts.

In the first order of importance may be mentioned the discovery of commercial reserves of gold in the Caucasus, a district as late at 1931 considered without gold deposits. By explorations in 1929 and 1930 there was found gold in the river silt of the Great and Small Laba, and also in natural ore bodies (red conglomerates) in the vicinity of these rivers. From 1930 to 1933 a series of operations have been carried on here. There was also discovered between the Rivers Belaya and Kuban "a rich stratum of gold-bearing ores." By the end of 1933 it had been proved without doubt "that in the Northern Caucasus there are very large deposits of gold of commercial significance suitable for use of powerful mechanical appliances (dredges. hydraulic appliances)." To the east gold deposits have been found on the Rivers Malka (near Nalchik), Fiagdon and Ardon. In 1934 explorations were carried on in the Balkar, Bezinga and Baksan gorges. The question of working the Malka sands with dredges was decided favorably. On the other side of the Caucasus range gold was found in 1934 in Svanetia, on the Dzirul heights and in the Barchala district. There are reports of gold in Gruzia, Osetia, and in other parts of the Caucasus, and a beginning was recently made in the exploring for gold in the Rivers Damblud, Pinazaur, Matavery, Gandzha-Chai and others. In 1933, in the village of Keiston, near the Great Laba River, a beginning was made in constructing a "gold combine," "Laba-Zoloto." The exploitation of the newly discovered deposits began in 1934.

The presence of analogous mineral deposits in the confines of the Azov-Podolia crystalline strata lends a basis for the decision of carrying on exploration in the Ukraine also: as a result there were found here, in 1934, deposits of gold in the Melitopol district, near the village of Novo-Nikolaevsk. Some deposits have also recently been found in the Nagol ridge.

Even larger commercial deposits have been uncovered in the gold finds in the Ural and the Trans-Ural. Very rich deposits of gold were found in 1933 in the North Ural and the Zaozersk district. In May, 1934, near Neviansk, there were found gold-bearing sands with gold content of 16 grams per cubic metre. A number of new deposits have been found in Bashkiri. Exploration has added greatly to the known reserves in Kochkaria, Maissa and other fields. Large geological exploratory operations were carried on in surveying the Berezovsk deposit, the reserves of which, going down to a depth of 200 metres, have been estimated at 500,000 kg. of gold. In connection with the discovery of a number of new gold-bearing strata, these reserves will be still further increased, permitting the Berezovsk deposit to be considered the richest in the Union, and even in the world. There is now being projected the construction of a large gold mining enterprise, "Bolshoi-Berezovsk," which will still further emphasise the significance of this mine in the system of the Ural-Zoloto Trust. The great increase of the reserves of the old workings and the discovery of a number of new, open before the Urals the most brilliant prospects.

The enormous reserves of reef gold in Kazakstan were first discovered under the Soviet rule. As a result of the work in 1933 the prospected reserves of gold were increased more than twenty times. Particular attention should be directed to the deposits of the central group—Stepnak, Dzhetygara, Dzhelambet, Maikain, Akdzhal and Kulundzhun—where many dozens of tons of gold are estimated to exist. In 1934 a number of new deposits were discovered here, both alluvial and reef, and the following deposits were studied with particular care: Dzhelambet, Baksy, Maikain, Aryk-Balyke, Ulu-Tau, Ak-Palake and others. At the present time it is possible to estimate without any doubt that Kazakstan in the next few years will become the most important centre for the recovery of reef gold in the Union, and will move forward to one of the first places in the Soviet gold industry on the basis of the absolute figures of gold recovery.

The Soviet gold industry has directed its greatest attention to investigating the gold resources of Central Asia. In Kirghizia, in the vicinity of Lake Issykkul, there were discovered nine gold-bearing areas, in the Khan-Tengri hills, there were located deposits of alluvial gold, traces of which were followed up for 50 kilometres. A number of new deposits were discovered in Uzbekistan, where, in 1934, work is being carried on in the deposits of Chatkal, Santalash and elsewhere. New gold-bearing conglomerates were located in Tadzhikistan. The expeditions of the Academy of Sciences uncovered outcroppings of gold in the Pamir and Tian-Shan ranges. Here a large gold-bearing district is outlined, the recovery of gold from which will seemingly be for a long time a matter for individual prospectors. The difficult contours of the district compel this.

In Altai, the geological exploratory work of recent years has disclosed potentialities of ore deposits which will place the Altai in its resources and possibilities of development of gold mining in one of the leading places in the U.S.S.R.

In Western Siberia one should not omit to note the prospecting in the district of the largest deposit, "Kommunas," where surveys have been run from the Podlunny Golets deposit, which has several dozen tons of gold: work has been pushed in the Sarilin combine district. In 1934 a number of new deposits were located on the Rivers Bia and Katuna.

The known resources of gold in the Yenisei Taiga were increased. Here the following ore deposits may be noted: Kliuchi, Rifman Mountain, the reserves of which are estimated at dozens of tons of metal.

The Trans-Baikal district has been enriched by a number of new deposits, the most conspicuous among them being Balei and Darisun. The first, recently opened up, has proved to be one of the leading gold mining enterprises in the Union. "By the average content of gold in the ore, and the value of the other components, copper, lead, arsenic, and also by the huge reserves, Darisun may rightly be called the jewel of our gold industry"—to quote from one report.

The beginning of mastering and exploiting the Aldan took place in 1923. By the fall of 1925 there were here already eleven fields (Nezametny, Zolotoi, Orochem and others). The productive area of the new gold-bearing district extends to 15,000 square kilometres, with the deposits running five to six metres deep and more. The average gold content is 10 grams in one cubic metre of sand. The latest explorations have disclosed ore deposits also which open to Aldan a possibility of long-time working. In spite of its short existence and the many difficulties of its geographical situation, Aldan as an economic unit plays a large part among the gold-bearing districts of the Union. In some years (1927-28) the gold recovered here reached 40 per cent. of that in the whole Union, and at the present time the Yakut-Zoloto Trust is one of the leaders in the Union, level with Lenzoloto. In the northern part of the Yakut-A.S.S.R., at the end of 1933 a gold-bearing district was discovered at the mouth of the River Anabara, the proved silts of which show a large gold content.

In the Far Eastern Krai a new gold-bearing district has been discovered in the upper reaches of the River Kolyma. The first indications of the presence of gold here were obtained in 1926. The expedition of the Geological Committee, sent there in 1928, extended considerably the limits of the district, opening up a rich gold-bearing area along the Rivers Srednekan and Utina. Those limits were still further extended by the expedition of the Academy of Sciences in 1929. "As a result of all explorations of the Upper Kolyma region, this must be regarded as one of the most promising. It may be considered proved that not only the backwaters of the rivers and brooks, but also the whole huge Cherski mountain range, the western foothills of which stretch to the Indigarka River, are fabulously rich in gold. The area of the new district is seven kilometres in length by 150 to 250 kilometres in breadth."

In the maritime Krai, on the Amar, a number of entirely new and very promising ore deposits have been found. In addition, all the working trusts have uncovered many new polygons very favorable in their industrial possibilities for the use of dredges, hydraulic and manual methods of recovering gold. In the words of A. Serebrovski, it may be confidently stated that "The resources of placer gold in our country are inexhaustible. We command the most colossal reserves of placer gold, with which the gold deposits of the United States, Canada, Australia and Guinea cannot possibly be compared."

Economic Data

Technical development of the Russian gold industry was halted by the War. The revolution and the civil war of 1918-20 were catastrophic in their consequences for the gold mining

enterprises and almost destroyed the recovery of gold as compared to that of goods, particularly foodstuffs, so characteristic of this period. The economic policy of 1918-20, by a series of decrees, limited the circulation of gold in the country, and finally, by the Decree of April 30, 1920, all gold industrial plants were nationalised and handed over to the monopolistic control of the State. The gold industry of Russia responded to this monopolisation by a further recession in output. For the purpose of restoring the mining industry, there was published on November 25, 1920, by the Soviet Government a decree guaranteeing to foreign concessionaires the integrity of capital invested by them in undertakings, these investments to be immune from nationalisation, confiscation, or requisition. This new decree, however, had no practical results. It was found necessary to seek means at home for the restoration of the gold industry. The decree of October 31, 1921, recognised the right of individual citizens to explore for and develop gold and platinum deposits, and the right to obtain claims on a rental basis. The decree of March 6, 1923, considerably extended the rights of private gold seekers. Finally, the decree of June 7, 1923, established the freedom of mining and revoked the decree of April 30, 1920. The need for gold at this time was extraordinarily great. Gold was valued higher in Moscow than in New York or London. From that date the restoration of the gold industry and the development of gold recovery began in the U.S.S.R.

A picture that is incomplete, for the actual quantity of gold recovered, but is relatively accurate so far as the changing position of the different gold-bearing areas of the U.S.S.R. is concerned in 1914 and more recent years is given in the following table :—

Production of Gold in the U.S.S.R. (in kilograms).

	1914	*1923-24*	*1924-25*	*1925-26*	*1926-27*
Ural Oblast	6,734	1,549	1,041	639	—
Bashkir Republic	1,217	1,605	2,347	1,972	—
Kazakstan	527	470	1,158	1,174	—
Siberian Krai	19,798	8,243	9,533	10,558	12,000
Buriat-Mongolian Krai	843	189	223	275	—
Yakutsk	—	2,457	2,129	7,034	5,200
Far Eastern Krai	12,378	2,082	2,839	3,292	4,470
U.S.S.R.	41,497	16,586	19,270	24,931	29,600

The decree of July 7, 1923, thus had real significance. The production of gold in 1923-24 increased more than twice in comparison with 1922-23. In the various districts of the U.S.S.R. a beginning was made in the creation of independent State trusts of local significance, Lenzoloto, Uralzoloto, then Yeniseizoloto, Zolotoruda. It was in these years also that there appeared a number of large private entrepreneurs of Soviet formation, such as Yakovlev, who leased the Berikul Mine, or a group of mining men who leased nine locations of placer gold in the North Yenisei district and four mines of ore gold in the South Yenisei, with all buildings, both dwelling and other, and equipment, four dredges, etc. For the first three operating years (1925-6 to 1927-8) the concessionaires recovered 25.3 metric tons of gold. On the other hand, the State enterprises also made considerable progress. Foreign concessionaires, up to 1925, played practically no rôle in the restoration of the gold industry. On October 1, 1925, the Lena Goldfields received as a concession the Lena-Vitim Rayon, with its centre in the town of Bodaibo. For the first three operating years (1925-26 to 1927-28) the concessionaire refined 25.3 metric tons of gold. By 1927 the position of the State enterprises had become so large that the gold-producing trusts were recognised as enterprises of all-Union significance. In that year the trusts : Aldanzoloto, Uralzoloto, Kazvoszoloto, Kazzapzolot, Sibzoloto, Yeniseizoloto, and Dalzoloto, together with a group of independent claims, "Stepniak," were joined together into one all-Union stock company, Soyuzzoloto.

Beginning with 1927-28 to 1932, no statistics on production and smelting of gold were published.

It was in those years particularly that the gold industry made the greatest progress. The State assigned to it huge funds, which were partly expended on geological prospecting and the preparation of new areas, but much more on the technical equipment of the gold mining industry. Great attention was also paid to the recruiting of new workers and attracting individual gold prospectors to the work.

The general technical advances of the recovery section of the Soviet gold industry are shown in the following table :—

	1913	*1925-26*	*1928*	*1933*
Electrical dredges	—	—	1	16
Steam dredges	69	24	28	69
All dredges	69	24	29	85
Hydraulic plants	15	12-13	32	190
American plants	—	—	1	6
Amalgamation plants	—	—	34	85
Chemical plants	—	8	11	51

The U.S.S.R., as may be seen from the previous table, has considerably changed, as compared with pre-War Russia, the application of mechanical methods of gold recovery toward a wide use of hydraulic methods. As concerns dredges, the electric drive dredges play a constantly increasing part. Great attention has been paid to the mechanisation of ore mining, the importance of which in the whole gold recovery programme has doubled compared with pre-War, as is shown in the following table :—

	1913	*1927-28*	*1928-29*	*1929-30*	*1932*
Ore gold	14.8%	22%	25%	25.5%	28%
Placer gold	85.2%	78%	75%	74.5%	72%

Even more striking is the change that has taken place in the structure of gold recovery from the tremendous use of mechanical methods of recovery :—

	1913	*1928-29*	*1930*	*1932*	*1933*	*1934*
Hand labour	80.2%	59.5%	48%	45%	32%	30%
Mechanical and chemical methods	19.8%	40.5%	52%	55%	68%	70%

Transport

Very great attention was paid to transport and the construction of new roads to the fields. The standing of motor transport in the gold industry on January 1, 1934, shows 39,919 horses belonging to the Trusts and 67,365 belonging to individual drivers, 407 tractors and 1,505 automobile trucks. In addition to the above there were at the disposition of the gold industry on January 1, 1934, the Bodaibo and the Nikolo-Pavdinsk railroads, transport within the gold recovery plants, and in the case of a number of enterprises (Botkinsk plant, Stroikrasmash, and others), and a fleet of boats on the River Lena containing 14 steam vessels of a total of 3,092 reg. h.p., and 55 barges, carrying altogether 17,480,000 tons.

Among the roads being built to the goldfields, the work done on constructing the Nifantiev road (Yenisei tract), the roads from Norsk to Stoiba and Yekimchan, and the Motyginsk roads deserve mention. There is also a road being surveyed to connect the Lena with the railroad. Roads are one of the great difficulties of the gold industry. The condition of the roads often limits the loading of work horses and trucks, and is the cause of rapid depreciation of means of transport. For the solution of the transport problems of so important a district as the Aldan, the question has been considered of supplying the foodstuffs necessary by way of the water route from Archangel to the mouth of the Lena, or the organisation of an air line from Yakutsk to Aldan, or from Aldan to Bukhlovo ; and even the possibility of delivering supplies by dirigible has been considered. For the realisation of the last undertaking, the Yakutzoloto Trust has undertaken to set up mooring masts in the Aldan and at the station B. Never.

Labor

Another very great difficulty of the gold industry up to very recent times, has been the question of sufficient numbers of workers. By means of offering a number of advantages to the workers, both in manufacturing and the prospecting divisions, this problem was solved. Among the more important decrees affecting the State gold mining properties, the following may be mentioned : the decision of the party forbidding the recruiting for another work of workers engaged in the gold industry, and granting that industry the right to draw workers from other branches of industry ; also the law of August 5, 1932, according to which workers in the gold industry were placed in a special position and received great advantages. On the other hand, the growth of the number of prospectors between 1930 and 1932 was restricted by several decrees of the Government, and still more by the hostile attitude of many local authorities to the so-called capitalistic method of gold recovery. Gold production by prospectors from 1930 to 1932 remained static,

in some years even dropped. For the purpose of raising production in this sector a decree was issued on February 26, 1932, by which prospectors were freed from hauling duties and from the agricultural tax, and were made equal in their rights with the workers in the gold and platinum industries. A particularly important influence in adding to the number of workers in the gold industry was the new system of buying the gold brought in by prospectors with goods, and the high purchasing power of this gold in comparison with paper money.

The following table shows the growth in the number of workers in the gold industry at the end of each of the years listed :—

	1913	*1922-23*	*1923-24*	*1925-26*	*1933*
Workers ..	88,608	13,574	14,010	29,676	More than 400,000

It must be noted that the figure for 1913 is probably much too small. The great increase in the number of men engaged in the gold industry in the past few years is due chiefly to the increase of the prospector class.

Gold Output

The series of exemptions extended to the gold industry from 1932 to 1933, the high purchasing power of gold and the rich technical equipment of the gold recovering enterprises has led to a large increase in gold production.

For the gold output in 1933 general figures were published, from which the conclusion may be drawn that the output of refined gold in 1933 was more than 84,000 kilograms, worth 108,500,000 to 109,000,000 roubles, which corresponds to the recovery of more than 100,000 kilograms of bullion. According to other figures, the production of the gold industry in 1933 ran over 100 million roubles ; on the authoritative statement of the head of Glavzoloto, Comrade Serebrovski, "The U.S.S.R. in 1933 in its production of gold for the year took first place in the world, if the Transvaal is omitted, and produced more than the United States (78,000 kilograms) and Canada (84,000 kilograms)." The chief article in the first number of the journal, "The Gold Industry," points out that "the delivery of gold to the State Treasury has doubled in comparison with the pre-War figure. This implies an output of bullion in 1933, also of not less than 100,000 kilograms, since the output of 1913 was equal to 60,846 kilograms. Of the gold production in 1932 and the fisrt half-year of 1934, statistics are given only in percentages of the output of 1933.

In comparing the various Soviet sources which supply total figures of gold production in Russia and the U.S.S.R. for the years 1913 to 1926-27, their total lack of agreement is conspicuous. The fact of the matter is that up to the time of the revolution, the industrial taxation was applied to the quantity of gold recovered ; therefore, the majority of the small and medium-sized gold industrialists were interested in concealing in their gold entry books part of the gold produced. The law of 1902, covering free circulation of gold, made it possible to deliver the gold concealed in this fashion to the gold assay laboratories. Therefore, in the calculations of the Mining Survey by no means all the quantity of the gold recovered was listed. After the Revolution, an analogous situation arose because of the fact that part of the private entrepreneurs, for various reasons, endeavored to deliver their gold directly to the gold assay laboratories, as gold brought in without compulsion. Another reason for the inaccuracy of the statistics is the inclusion by the author in the one figure of both bullion and refined gold ; sometimes figures are given in one table for the fiscal and calendar years ; sometimes the statistics are simply incomplete or not verified from authoritative sources ; often the same source at different times or even at the same time shows different figures for the recovery of gold. All this points to the general inaccuracy of the statistics of gold production in Russia and the U.S.S.R. Taking the output in 1927 at 100, official estimates of increase in the succeeding years were 111 in 1928, 134 in 1929 ; 177 in 1930, 209 in 1931, 248 in 1932 and 350.9 in 1933. Using these percentages as a basis and taking the production of fine gold in kilos in 1927 at 24,900 we get the following deduction figures : 27,600 kilos in 1928, 33,400 kilos in 1929, 44,100 kilos in 1930, 52,000 kilos in 1931, 61,800 kilos in 1932 and 87,400 kilos in 1933. As a confirmation of the accuracy of these figures, the announcement of the head of the Glavzoloto, Serebrovski, will serve, to the effect that in 1933 more than 84,000 kilograms of gold were refined in the U.S.S.R. To summarize the foregoing : there was a considerable drop in the output of gold from the second year of the World War. During the years of the civil war and War Communism, the output of gold fell to 2,000 kilograms, worth 2,500,000 roubles. When the New Economic Policy was introduced in 1921 a restoration of the gold industry began, reaching, however, the pre-War level only in 1931. In 1933 not less than 105,000 kilograms bullion were recovered and more than 87,000 kilograms of pure gold, worth not less than 113 million roubles. In the present year, seemingly, this level will be far exceeded since the gold industry continues to develop rapidly.

Hsinking Has Biggest Radio Station

THE Y.2,500,000 Hsinking radio station, completed in June, 1934, the Manchou-Japanese Telegraph and Telephone Co. after 13 months' construction work, is unquestionably the largest in the Far East. The concern is a joint undertaking by Manchou and Japanese shareholders and controls telegraph and telephone services in Manchuokuo and Kuantung leased territory.

It functions primarily as a transmitter and receiver of radio messages throughout Manchuokuo, between Japan and Manchuokuo, and between Japan and North China. It intends eventually to serve as a connecting link in the world's radio system.

Inasmuch as a long distance telephone network has connected for some time practically all corners of the globe save a portion of the Orient, namely Japan, Manchuokuo, and China, the completion of the Hsinking radio station marks an epoch in the long distance telephone's history.

Has Four Sections

The Hsinking radio station really consists of four separate sections, viz., the Kuanchengtzu transmitting station, the Mengchiatun receiving station, the Hsinking radio telegraph control station, and the Hsinking radio telephone control station.

The Kuanchengtzu transmitting station is about a kilometer northeast of the Kuanchengtzu station on the North Manchuria Railway and has a 650,000 tsubo tract. The Mengchiatun receiving station is about three kilometers northeast of the Mengchiatun station on the S.M.R. and has a 600,000 tsubo tract.

The latest scientific equipment has been incorporated in the Hsinking radio station, from the huge antennas to delicate tools. These were all made in Japan.

Connected with World

It is now a simple matter for the Hsinking radio station to communicate with Tokyo, Osaka, San Francisco, Berlin, and other distant cities. It is also possible for telephone subscribers in Hsinking to converse with anyone in Japan by direct radio telephone services.

It is the intention of the management eventually to open direct radio telephone service with Britain, the United States, France, South China, the Malay archipelago, and British India.

At the Kuanchengtzu transmitting station there are nine towers with inverted aerials, designed for communicating with Europe and America. There is nearby a score of secondary tower as well.

Within the building are installed several high powered short beam transmitters, powerful generators, beam adjusters, cooling tanks, and circuit pumps, all of which enable the station to transmit 200 words a minute.

Mengchiatun Features

Among the distinct features of the Mengchiatun receiving station are scores of towers, designed to conquer "fading phenomena" and several Japan-built long distance short wave receivers, which are regarded as the last word in equipment of that sort.

The Hsinking central radio telegraph control station is where the radio messages to be transmitted and received are really handled. It has several high speed automatic transmitters and tele-typographs, automatic perforators, and special typewriters for taking care of messages received.

The Hsinking central radio telephone control station is where the radio telephone messages transmitted by the Kuanchengtzu station or received by the Mengchiatun station are handled.

The Hsinking radio office is only a portion of the communications work performed by the Manchou-Japanese Telegraph and Telephone Co. which operates throughout the new empire on a huge scale.

New Chinese Alcohol Distillery*

Plant Under Technical Supervision of Overseas Chinese Producing Over 6,000 Gallons Daily

ALTHOUGH the new alcohol distilling factory, erected in Pootung, has been in full operation since the beginning of the year, and is reported to be doing a thriving business, its formal opening did not take place until the end of March. Then it was launched upon its career under the highest Government auspices. This is fitting, as the factory may be regarded as a typical example of the semi-official industrial enterprise which the authorities are now constantly endeavoring to foster, with the object of making the country gradually more self-supporting and less dependent upon imported products.

The distillery is using kaoliang, maize, dry sweet potatoes and liquid molasses as its raw materials. At present, the molasses are imported, but it is hoped that, in time, it will be able to meet all its requirements by purchases on the home market. The alcohol, which is being produced in quantities ranging between 6,000 and 7,000 imperial gallons a day, is of a standard quality of 96.7 degrees, and, after subjecting it to analysis, the Shanghai Chemical Laboratory has certified that it conforms in every way to the requirements of the British Pharmacopœia. It is, so the certificate runs, alcohol "of a high standard of purity and fit for human consumption."

Under present conditions, the factory's full capacity is 7,500 gallons daily, but within three months the output could be doubled and the management of the undertaking are satisfied that they are equipped to fill practically the whole of the Chinese demand. This actually is their objective and they believe that their technical efficiency in production and the high quality of the product, coupled with a low selling price, will enable them to reach it.

To deal in the first place with the selling price! Formerly, imported alcohol paid three tael cents per gallon in Customs duty. At the beginning of this year the tariff was raised to 44 gold units, or, approximately, 80 cents a gallon, which naturally gives the local industry a very solid protection. Imported alcohol now sells at over $2 a gallon, whilst the product of the new China distillery, after including the consolidated tax of 59 cents a gallon which it is called upon to pay, can put its product on the market at well under this figure. There has been insufficient time yet to judge the full effect of these changed conditions, but, according to the Customs returns, the quantity of alcohol imported into Shanghai during the first two months of this year was only a half of that imported in the corresponding period last year, and it would appear certain that, sooner or later, these imports must be checked entirely. Of course, the consumer has to pay, for alcohol was obtainable at around $1 a gallon less than a year ago, but in view of the fact that the spirit is used in only comparatively small quantities for a large number of industrial purposes—for the manufacture of perfumery, paints, chemicals, ammunition, and so forth, in addition to the amounts required for wine, it is not considered that this will cause any hardship. On the other hand, the revenue for the Government may be easily calculated. Taking the output at the conservative estimate of 7,000 gallons, the tax of 59 cents a gallon will yield over $4,000 a day, or, say, in round figures $100,000 a month.

There were four small alcohol distilleries previously established in Shanghai and about eight others in different parts of the country. They are comparatively small concerns, the largest of them probably not producing more than 1,000 gallons daily, and whether they will be able to compete successfully with the new enterprise remains to be seen, the question, of course, depending upon their management and particularly upon the efficiency of their production methods.

In the new Pootung distillery the greatest stress is laid upon a high standard of technical supervision. This is provided entirely by Chinese, but by Chinese who have had wide experience in similar undertakings in Java.

The Company, which is named the China Alcohol Distilling Company and operates directly under the Ministry of Industry, was formed by the Central Government working in co-operation with a number of overseas Chinese and prominent Shanghai merchants. A capital of $1,500,000 was decided upon and about 150 mow of land on the Pahlien Kyung Creek, having a sufficient deep water frontage on the Whangpoo for the berthing of two steamers, was purchased as the site of the factory. Construction was commenced in May last year and by the middle of November the distillery was built and completely equipped, which is probably a record for any undertaking of a similar size in China.

The mercantile interests in the enterprise are represented by the Kian Gwan Company, who act as General Managers, Mr. K. C. Huang, the Managing-Director of the Kian Gwan being also Chairman of the Board of Directors of the distillery. The Kian Gwan Company own and operate a large laboratory, five sugar, and several other, mills in Java and the installation of all necessary machinery was supervised by their technical staff.

The distillery apparatus, which was supplied by Blairs, Ltd., of Glasgow, who have an international reputation for this type of plant, is a replica of the most modern equipment to be found in the British distilleries. Steam is furnished by two Babcock & Wilcox boilers of the water-tube type, having a heating surface of 3,900 square feet. Water is obtained from a well 700 feet deep, capable of producing 30,000 gallons an hour, and is pumped with an air compresser and a centrifugal pump into a water tower 120 feet in height. Coal is fed to the furnaces by mechanical chair grate stokers. Indeed, throughout the factory practically all operations—from the conveying of raw materials from the wharf to the delivery of alcohol in drums—are carried through by mechanical means. Hand labor is reduced to a minimum and, consequently, the factory, considering its size, employs only a small labor staff. These men work an eight hours a day shift and plans are under consideration for providing a swimming pool and other means of recreation for their benefit.

Finance and Commerce

The New Distillery Erected at Pootung for the China Alcohol Distilling Company

Iron Mining in the Philippines*

IRON mining in the Philippines is a comparatively new industry, on a modern scale, although evidences have been found that iron ores were exploited here during Spanish control. There is but one iron mine in extensive production at the present, that of the Philippine Iron Mines, Incorporated, near Mambulao, in Camarines Norte. This concern is mining around 1,000 tons of high grade iron ore a day, and has shipped more than 70,000 tons.

The only shipments of ore at present go to Japan, and the company has a contract for the delivery of 200,000 tons during 1935. This amount is a very small part of Japan's requirements for the year, which will probably run as high as 4,000,000 tons. Most of this will come from China and Federated Malay States, although 300,000 tons are actually contracted for and are being shipped from Australia. Most of the iron ore used in Japan in 1934 came from China, the Federated Malay States, and Australia. In addition to this, Japan imported 1,500,000 tons of scrap steel for blast furnace consumption from the United States. During the past 30 years the United States, including even the depression years, has had an average yearly production of about 50,000,000 tons of iron ore. By way of comparison, the requirements of the Philippine Islands in iron and steel products are so modest that if blast furnaces could be operated here, it has been estimated that the iron ore deposits of Surigao, reserved by executive proclamation, are more than enough to supply all requirements for a period of at least 250 years.

Iron ore cars being loaded by hand. Under management of the Atlantic, Gulf & Pacific Company 200,000 tons of iron ore will be shipped this year to Japan from Camarines Norte

The Philippine Iron Mines, Incorporated, is under the control of the Atlantic, Gulf and Pacific Company, of Manila, which acts as its general manager. The president of the company is N. E. Mullen; the vice-presidents, Andres Soriano and Frank B. Ingersoll: the treasurer, William Douglas. Directors are Rafael Corpus, F. T. Fitzimmons, S. Garmezy, L. D. Lockwood, Francisco Ortigas, W. J. Shaw, in addition to the officers named above. Operations at the mine are in charge of M. R. Cort, general superintendent. Mr. Cort has been connected with the Atlantic, Gulf and Pacific Company for eight years, and had charge of the construction of three docks in Cebu for them.

It is probable that during some period in the past a primitive iron industry was carried on. Information about this industry is to be found in a report made by F. R. Tegengren, formerly of the China Geological Survey, Peking, China, in a publication of the Bureau of Science in February 1927. Tegengren made an examination of the property in 1923 for a Chinese iron mining concern, and returned to the islands in 1930 to conduct a thorough survey for the Atlantic, Gulf and Pacific Company. The historical notes on the mine in this article are condensed from Tegengren's reports, furnished by courtesy of Judge Frank B. Ingersoll.

It is recorded that concessions for iron mines on Calambayungan island were repeatedly sought during the Spanish control of the Philippines (this island, and Larap peninsula, on the west side of Mambulao bay, in Camarines Norte, now are the workings of the Philippine Iron Mines). It is also known that iron ores farther north in the Luzon cordillera were exploited in the 17th and 18th centuries. Probably the Mambulao deposits were discovered at a similarly early date, since gold mining is known to have been carried on for 300 years in this region.

In 1918 A. C. Cavender, a mining engineer who had been engaged in gold mining in the region for many years, and Joaquin Casanovas leased holdings which they had acquired on Calambayungan island to a Japanese company. This Japanese concern planned to ship ore to Japan for smelting in blast furnaces. A wooden pier, about 120 meters long, was built, and a narrow-gauge railroad track laid down. Ordinary bench-quarrying methods were used, but most of the output came from boulders and rubble occurring in the superficial clay. Ore was delivered by means of wooden chutes to the lower benches on the railroad, and loaded into hand cars to be dumped into scows at the pier. About 300 to 500 men were employed, and the daily output at times reach 150 tons. In 1919, the war boom over, operations were stopped, and the property restored to its owners. Around 48,000 tons is reported to have been shipped, most of it coming from surface rock, as no systematic prospecting or development was done by the Japanese leaseholders.

A large mining concern that was investigating the Mambulao gold deposits did a considerable amount of exploratory trenching work, both on Larap peninsula and on Calambayungan island, in 1923. This work was in the hands of E. A. Heise, an American who for 18 years had traveled extensively in the islands engaged in gold prospecting, dredging, and mining. Through his energetic efforts valuable information was obtained from this exploration work.

The extent of the iron ore deposits, as reported by Tegengren and as learned from Heise's work, is as follows:

	Larap Peninsula	*Calambayungan Island*
Length of iron formation ..	700 meters	480 meters
Lateral extent along the dip ..	100 meters	100 meters
Average thickness of ore ..	7.3 meters	4.8 meters
Volume of ore	511,000 cubic meters	230,000 cubic meters
Tonnage	2,040,000	920,000

After Tegengren made his report in 1930, however, the ore reserve was estimated at 3,000,000 tons, and a second report on the property increased this amount to 4,500,000 tons. The ore in both deposits consists of nearly pure hematite, with a very subordinate intermixture of gangue matter. It is partly hard and crystalline, partly soft and friable. A complete analysis of mixtures of all the samples taken showed that the ore averaged from 62.3 to 63.8 per cent metallic iron, from .04 to .09 per cent phosphorus, and from .09 to .18 per cent sulphur. Most of the ore is easily mined, the very simplest quarrying methods being used.

Work on the present project was started in 1934, when, on April 11, Mr. Cort and a crew of 40 men reached the property overland. The crew consisted chiefly of carpenters and mechanics and work was started at once on camp buildings. A scow of lumber arrived at the site soon after, and within 11 days five houses had been built. Over 250 laborers were on the job by April 21, and the work went ahead rapidly. What is said to be the longest railroad bridge in the islands was built from the peninsula to the island, and a pier 365 feet long, with a depth of 30 feet of water available at low tide, was constructed. Ships up to 10,000 tons can berth here.

The first six months was devoted to the building of the camp, the bridge, and pier. The first boat arrived October 9, and was being loaded during the worst typhoon of the year, October 15. Since that time some 67,000 tons of iron ore have been shipped, and it is planned to load three or four boats a month. The boat

**The American Chamber of Commerce Journal*

that loaded during the middle of April, a Greek freighter, was the eighth to carry ore to Japan. At first it was planned to ship 100,000 tons a year. The 1935 contract calls for 200,000 tons.

The mine camp is complete in all details. A P.6,000 hospital has just been completed. A complete canteen is maintained, where the laborers can obtain everything for their wants and pleasure at reasonable prices. Some 1,200 men are working on the project, and the majority of them are permanent residents of Larap. Mining is by hand methods for the most part, much of the work being on a contract basis. A 50 kilowatt diesel power plant is planned for the near future, and will supply light and power for night operations.

At present, of the daily 1,000 tons mined, 650 tons is taken from Larap, and the remainder from the island deposits. Much of the ore is stacked by the tracks, so that the various grades may be sent to the boats as wanted. The mine is being worked by the Atlantic, Gulf and Pacific Company for the Philippine Iron Mines on a 50-50 basis. Mr. Cort, in charge of mining operations, went to Larap with no previous mining experience, but with an exceptional record as a construction engineer and as a leader of men. The work he has accomplished at the iron mine is a tribute to his ability.

Japanese Power Merger

A merger of two of the " Big Five " of Japan's electric power companies, the Daido Electric Power Company, of Tokyo, and the Ujigawa Electric Power Company, of Osaka, is very likely in the near future, according to the *Yomiuri* and other papers. The banking interests behind the two companies are understood to have been negotiating for the merger since last autumn, with considerable success.

Both companies have outstanding balances of funded borrowings from the United States, Daido Power to the amount of $16,000,000, raised through Dillon, Read & Company, and Ujigawa Power a smaller amount, raised through Lee, Higginson & Company.

The papers give the impression that the merger proposal was initiated by Mr. Norihiko Yatsushiro, chairman of the board of directors of the Sumitomo Bank, which has financial control over Ujigawa Power. Last fall, when Daido Power was compelled by pressure from the Electric Federation to suspend its competition with the Tokyo Electric Light Company in retailing power in the Kwanto, Mr. Yatsushiro foresaw that it would compete with Ujigawa Power in the near future in the Kawasaki, where its interests are extensive.

Chinese Telegraphs

Resolutions relating to the telegraph and telephone administrations have been adopted by the National Telephone Conference at Nanking. With regard to the telegraph service, a big scheme was approved. It was decided to repair all the national trunk and branch lines. Light telegraph lines, originally for military purposes, will be taken over and repaired with funds from the Boxer Indemnity Refunds. In order to expand the wireless service to South China, the conference decided to recommend installation in Shanghai of four 2-kilowatt automatic radio apparatus for communication with Foochow, Amoy, Swatow and Canton. The conference decided that, as far as possible, telegraph materials should be native made. It was also decided that the telegraph apparatus manufacturing works be re-opened and that branches be established at Peking (or Tientsin) and Hankow. A factory for the manufacture of telegraph accessories is also to be established. A telegraph materials improvement experimental station will be established with a view to training experts ; an international wireless research institute will be opened ; and a telegraph research laboratory installed in the apparatus manufacturing works. Telegraph officials are to be dispatched abroad for practical training. Employees of the International Radio Station, who have been on service for four years, will also be sent abroad for practical training.

Soviets Commence Giant Industrial Plants in Siberia

(*Continued from page 230*)

is under contemplation with an appropriation of 200,000,000 roubles. The connecting line is called the Birakan-Bureya line. In 1934, a party of 130 adventurer-experts led by Chief-Engineer Atalantsev conducted surveys in the district. Then, the construction headquarters was opened at Bureya. This line is to be finished by 1937 when the " Burejastroy " plan will be put to execution. Most factories will be founded at Bureya.

Isolation Difficulties

The " Burejastroy " plan in this part of Siberia is handicapped in many respects. Bureya is far distant from supply centers of machinery and technical skill and labor supply. To make matters worse, food stuffs for a population which will rapidly grow are unobtainable in the district.

The Soviet government may plead that rich natural resources in Siberia have had to be left unexploited under such handicaps which, however, will be totally removed by a development of heavy industries. Soviets may add that an industrialization of Siberia will transform the neglected region into a land of promise.

New Turbo-Generators for Manchuria Are being Supplied by the A.E.G.

(*Continued from page 216*)

The time of service of a steam turbine is practically unlimited, especially if attendance and supervision are always carefully accomplished.

Most important in this connection is the supervision of the live steam conditions and of the oil supply and oil purification.

The wear of the blades can be diminished up to certain degree through up-to-date materials and suitable blade profiles, but it cannot be completely avoided. This means, however, that the strongest blade using the highest material quantity is the safest and guarantees the longest time of service. The strong design of the A.E.G. impulse blade, the cross section of which is about three times higher than the cross section of the usual reaction type blade is specially remarkable in this respect. Moreover, thorough investigations have shown that erosions in the low pressure stages due to high moisture of the exhaust steam occur earlier and in greater extent at low pressure stages with high percentage of reaction.

Nanking is Extending Power Facilities of its Electrical Plant

(*Continued from page 222*)

burners and the other the lower burners. Hence at light loads only one mill will be in use.

Provision is made for tube cleaning by the installation of six Bayer soot blower elements per generator Four of these are mounted so as to blow the water walls comprising the combustion chamber and the remaining two will clean the horizontal and vertical banks of convection tubes respectively.

Among the boiler accessories of American manufacture selected are Copes feedwater regulators, Reliance gauge columns, Crosby steam gages and Edward blow-off valves. Extension of the existing coal handling system is being furnished by the Jeffrey Manufacturing Company. The forced and induced-draft fans, it is understood, have been ordered abroad.

The steam generators were shipped from the United States late in December and are now being erected.

Motor Coaster for Fiji Islands

THE Motor Coaster *Tui Cakau* illustrated on this page was built by Messrs. Harland & Wolff, Ltd. to the order of Morris Hedstrom (Fiji), Ltd., to replace one of their vessels recently lost. The vessel was fabricated and erected at the builder's works at Woolwich. It was dismantled for shipment to Suva where it was re-erected for service. This vessel is the first to be steel-built for a trade which has hitherto been run with wooden craft, and Dalzo rust-resisting steel, supplied by Colvilles, Ltd., has been utilized in her construction.

The principal dimensions are as follows :—

Length, between perpendiculars ..	85-ft.
Breadth, moulded	19-ft.
Load draught (mean)	6-ft. 6-in.
Load displacement	183 tons

The vessel is of the single screw type with bar keel, one deck, raised forecastle, and one large cargo hold. The machinery is situated aft.

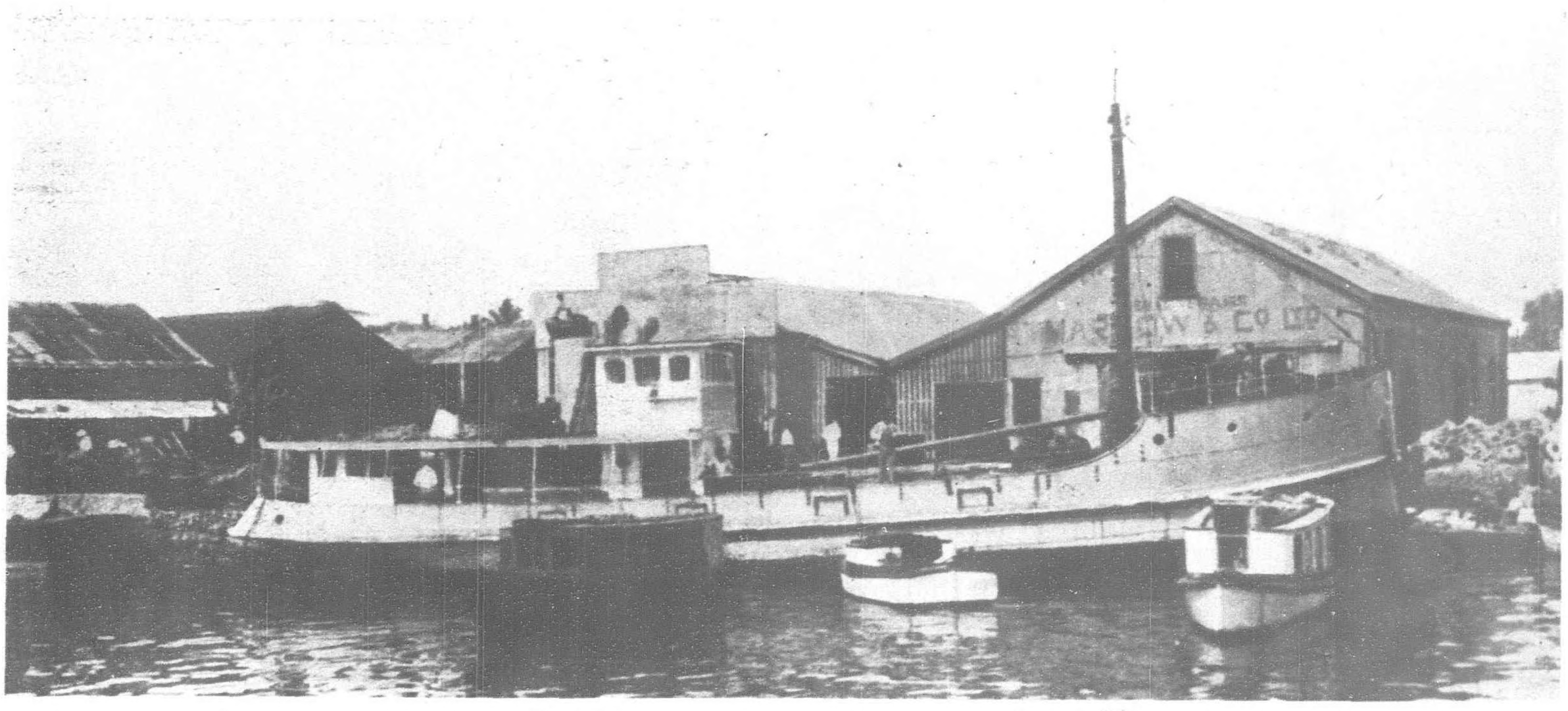
The main propelling machinery, supplied by Petters, Ltd., is a three cylinder, Atomic Diesel marine engine, developing 145 b.h.p. at 375 r.p.m. This engine is of the direct reversing type, and starts from cold by compressed air. It is equipped with single hand wheel control, with which the engine is started, reversed, stopped and controlled in speed. Built into, and operated by the main engine, are an air compressor, bilge and circulating water pumps, and a fuel oil transfer pump.

The engine is direct coupled through an intermediate shaft to a bronze propeller shaft, and four bladed 47-in. dia. bronze propeller. A gun-metal sterntube is furnished ; this with the bronze shaft and propeller, provide the necessary protection against the excessive galvanic action of sea water in tropical climates.

The exhaust from the engine is carried from the water cooled exhaust manifold, through a secondary silencer, to the funnel. This secondary silencer is heavily galvanized to resist any corrosive action.

The auxiliary equipment consists of a five b.h.p. Petter engine, running at 600 r.p.m. which is clutch connected on one side to a two stage single acting Hamworthy air compressor of nine cu. ft. displacement, and on the other side to a general service pump for auxiliary, bilge, ballast and dock purposes, having a capacity of 15 tons of sea-water per hour. This pump is manufactured by Messrs. Dawson & Downie of Clydebank. The auxiliary air compressor, together with the built-in compressor, charges the air receivers for starting and reversing the engine.

In the past the owners have had sailing schooners or cutters with auxiliary engine power. The abandonment of sails, and the adoption of Diesel drive for the propeller is an indication of the general forward trend in this design of coasting vessels.



The Motor Barge "Tui Cakau" with 145 b.h.p. Atomic Diesel Marine Engine built by Messrs. Harland & Wolff, Ltd.

Highways in China

The building of highways in China is advancing by leaps and bounds. The Highway Construction Committee of the National Economic Council report recently that more than 5,700 kilometers of modern highways have been constructed in the eight Central and South-Eastern provinces of China since the inception of the Roads Bureau in May, 1932. Co-operating with the provincial governments of Kiangsu, Chekiang and Anhwei, the Bureau has also helped complete six highways linking up these three provinces. The Bureau has also co-operated with the Fukien Provincial Government in building a 872 kilometer highway along the Fukien-Kiangsi border, and has granted a loan for the building of a 570 kilometer road along the Kiangsi-Kwangtung-Fukien border.

Road construction work in Shensi and Kansu in connection with the rehabilitation of the North-West is proceeding. Many graduates of schools of engineering have left Shanghai this summer to help in this work. The road between Sianfu, capital of Shensi, and Lanchow, capital of Kansu represents an important sector of an historic highway connecting Central China with the populous areas of Central Asia and beyond. It was along this route that the silk caravans were dispatched to Asia Minor for trade with the Western World. Such a highway will be a means of connecting ports in North China with vast areas untouched and reachable now in many cases only in from two to six months by means of camel caravans. It is calculated that such a highway will reduce travel-time to three or four weeks by regular motor-truck service. Linking up Shensi-Kansu-Szechuen is to be another important highway, 223 kilometers long and valued not only for its commercial uses but also for its strategic position.

Engineering Notes

INDUSTRIAL

GRAHAM-PAIGE MAN.—Mr. E. P. Curtiss was recently appointed factory representative to cover the Far East Territory for the Graham-Paige International Corporation, Detroit, Michigan, U.S.A. Mr. Curtiss sailed from San Francisco in January, planning to stop at Honolulu and then continue to Japan, China, the Philippines, Dutch East Indies and India. Mr. Curtiss is well known in that part of the world, and covered the same territory for Graham-Paige in 1930, 1931 and 1932.

IRON AND STEEL IN JAPAN.—The Japan Iron Manufacturing Co. is to erect a 1,000 ton smelter, a 1,400 ton coke furnace, three open hearths each of 60 tons capacity, and two electric hearths each of 15 tons capacity, all at the Yawata Works. In its Kamaishi Works also will be installed a 60 ton open hearth. The Showa Steel Co. recently applied to the Kwantung Government for permission to construct equipment to increase steel production by 500,000 tons. This company will begin to operate in April, but its first year's production will be one-half its total capacity of 300,000 tons. Notwithstanding this, the company has received orders for 700,000 tons next year. Showa Steel needs Y.26,000,000 for plant increase. The funds are expected to be raised through the South Manchuria Railway.

HUAI RIVER WORKS.—An agreement was signed on January 12, for a sterling loan of £238,000 to be granted by E. D. Sassoon Banking Co., Ltd., to the Huai River Commission to finance the construction of the Chiangpa Regulator of the Huai River. The loan is secured on a portion of the Boxer Indemnity Funds. For the conservancy of the Huai River, which has worked constant havoc in Kiangsu, funds amounting to $7,000,000 have been raised and 160,000 workers enlisted. It is estimated that, on completion of the task, about 5,000,000 *mow* of fertile land will have been reclaimed. Of the total funds, $5,000,000 is understood to have been loaned from the Sino-British Boxer Indemnity Fund, the remainder to be raised by Conservancy bonds. The first stage of the work centers upon improving the channel between Yangchuangchen, Huaiyin and Taotzekou, for a distance of 170 kilometers. The upper reaches will follow the old bed of the Yellow River, but for the lower part a new channel to the sea will be dredged.

STEEL MILLS FOR CANTON.—There are projects in Canton which involve the construction of a new bridge across the Pearl River, new wharves and new godowns, etc., but most important of all is the decision of the Provincial Department of Reconstruction in Canton to establish an iron and steel works. Although the project calls for the sanction of the National Government, British, American, and German firms have already made tentative offers for the supply of the plant. The project entails a loan of more than £2,000,000, the equipment to be purchased including a blast furnace of 500 tons, rolling mills, and a steel-making plant. British firms which have been negotiating for this work are Fraser and Chalmers, H. A. Brassert and Co., and Dorman, Long and Co., Ltd. American firms interested are Arthur G. McKee and Co. (Cleveland, Ohio), the Perin Engineering Co. (New York), and Allis Chalmers Manufacturing Co. (Milwaukee). The vice-president of the McKee firm, Mr. William A. Haven, visited Canton last year and made the acquaintance of many Chinese officials and others interested in this project. The German firms seeking orders for this plant include Krupps of Essen and Demag of Duisburg.

ELECTRICAL

POWER COMPANY PROJECTED.—The Electro-Chemical Industry Company has decided to undertake a self-supply of electric power in three localities in Japan and to this end intends to establish a company capitalized at Y.20,000,000.

HIGH VOLTAGE LINE IN URALS.—A high voltage line connecting Sverdlovsk and Kalata, distance of 850 kilometers, was put into operation on November 7. The line links the towns of Cheliabinsk, Tagil, Zlatoust, Berezniki and other Ural industrial centers.

IRRIGATION IN SHANSI.—Irrigation projects which might bring to south-west Shansi a welcome prosperity are outlined by Mr. O. J. Todd in a report submitted to the Shansi Water Conservancy Commission. Their chief object is to furnish cheap power for irrigating plateau lands in the Hotung region and to furnish low-priced power for industrial development along the Fen Ho. The projects comprise the installation of hydro-electric plants of 50,000 horse-power at the Yellow River Falls, of 1,400 horse-power at the Kwang Sheng Sze Springs, of 400 horse-power at the Chu Wo Falls, and 250 horse-power at the Chintze Springs. They also include pumping plants at Hotung of 265,400 gallons per minute, at Yumenkou of 8,623 gallons per minute and at Lungmenchu of 134,640 gallons per minute. The biggest project is obviously that at the Yellow River Falls. It would rival many large undertakings of the same kind in Europe, Africa and America. The total cost of the installation is estimated at about $7,000,000 with annual charges on completion of about $990,000. Mr. Todd estimates that within five years the whole of this new power at the Yellow River Falls would be economically absorbed.

POWER FOR SOUTH KOREA.—The Electric Power Federation of Japan has approved a scheme for power development in Southern Korea. The Big Five companies are expected to take part in a scheme to found a steam power company with a paid capital of Y.10,000,000. The company will erect a 35,000 kw. steam station at Neietsu, in South Korea. Later, it may go into hydro-electric power generation. Coal mined at Neietsu by the Government would be used. The northern Korean territory is already thoroughly developed from a power point of view. In the south, the Government owns water power franchises on the River Kanko, which are capable of turning out 250,000 kw., plus 40,000 kw. of capacity on the Rakuto, but it has never had the money to develop them.

HSIKIANG HYDRO-ELECTRIC PLANT.—Arrangements concluded with a syndicate of American bankers by the Kwangtung provincial government of South China, for a loan of 50,000,000 yuan with which to erect a steel mill and a hydro-electric plant at Hsikiang, have been objected to by the Central Government, on the ground, it is reported, that it is contrary to the principle proclaimed that provincial governments should not act on their own authority. Despite financial difficulties, the provincial government, in pursuance of its three-year plan of reconstruction, is pushing forward industrial undertakings. According to the Statistics Bureau, the number of factories to be built within three years is 24. The amount appropriated for them is more than $96,000,000. The number of factories already started operations or still under construction is 21. The amount expended so far is estimated at $15,390,000.

POWER PLANT FOR KYUSHU.—Kyushu Hydro-Electric Power Company has been given sanction to develop water power to the volume of 50,000 kilowatts at Tsukahara, on the Mimi River. The largest power generating station in Kyushu will be erected at a cost of Y.17,000,000.

AVIATION

JAPANESE INTENTIONS.—An ambitious plan for air expansion in Japan has been decided on by the Imperial Aviation Association. This includes the provision of 300 new aerodromes and the organization of volunteer flying corps. The Association also intends to help private air organizations as much as possible. The Army and Navy may support the plan by supplying machines and in other ways. Schemes are also afoot to improve light aeroplanes and encourage gliding.

EXTENSIONS IN CHINA.—A cable states that the Nanking Government has given permission for Imperial Airways Ltd. to fly over Chinese territory on any Singapore-Hongkong service which may be started. In return the Government have been trying to get permission for the Chinese lines to extend to Hongkong, and a representative of the China National Aviation Corporation went to Hongkong late in January to discuss this. Latest reports say nothing of a possible British extension to Shanghai.

AEROPLANE FACTORY.—Over $500,000 worth of machinery has arrived from the United States and will be used by the Army of Kwangtung for the installation of an aircraft works at Shaokuan, 150 miles north of Canton. Several American engineers have also arrived to assist in setting up this machinery. The new factory will manufacture not only the bodies of the aeroplanes, but also the engines. The coming iron and steel works will supply the metal, and the new hydro-electric power station at Yungkiang will drive the machinery.

ALL-STEEL PLANE.—A new all-steel plane, the first of its kind to be constructed, is nearing completion at the Moscow Aviation Institute. The plane, which will have a cruising speed of 320 kilometers (200 miles) per hour, is destined for service as a long-distance express passenger plane. It is constructed of rust-proof steel parts, electrically welded.

FACTORY FOR AIRPLANES.—The new airplane factory and assembling plant of the First Army Corps of Canton is nearing completion and will be in operation soon.

The first step will be the manufacture of airplane bodies and as soon as the special machinery is received from abroad motors will also be manufactured. The monthly expenses for the factory have been estimated at $80,000.

AIR DEFENCE.—One of the results of a recent conference at Singapore between Major-General F. W. Barron, Inspector of Fixed Defences and senior officers of the Royal Air Force is a proposal to extend the air defences of Singapore and Hongkong. The present strength of the R.A.F. in the Far East, apart from Fleet Air Arm Units, is one flying-boat and two torpedo-bomber aeroplane squadrons at Singapore and a small base at Kai Tak near Hongkong.

AIR BASES IN BORNEO.—Sites for six new aerodromes have been selected in Borneo for the projected route between Singapore and Hongkong by way of Borneo and the Philippine Islands, according to a *Reuter* message from Singapore. *Colonel J. F. Turner, D.S.O., who is* Director of Works and Buildings in the Air Ministry, announced at Singapore on his return there from a tour of the sites by flying-boat, that they met with his complete approval. The new aerodromes will be at Kuching, Bintulu and Miri, in Sarawak and Labuan, Jesselton and Kudat in British North Borneo. The suggestion is that they may serve as the final link in a service across the Pacific from America to Singapore by way of Honolulu, Wake Island, Tokyo and Shanghai.

MINING

GOLD NEAR ARMAVIR.—Presence of gold was discovered in the sands of the Urupe and Kuban rivers, near Armavir, in the North Caucasus.

MANGANESE DISCOVERED.—Large deposits of manganese ore were recently discovered near the villages of Uruk and Kuligy in the Udmertsk region. The ore is said to contain as high as 40 per cent of metallic manganese.

GUSHER AT BAKU.—A gusher producing over one thousand tons of oil the first day and five hundred tons daily thereafter was recently brought in at Baku. The high productivity of the gusher, brought in from a depth of 1,655 meters and indicating the presence of large quantities of oil, has led to extensive drilling in the vicinity.

GOLD IN ANHUI.—A gold mine has been discovered in the Chihchi district in eastern Anhui near the Chekiang border, according to a report received here from Anking, provincial capital of Anhui. It is understood that the Reconstruction Department of the Anhui Provincial Government has dispatched several mining engineers to the district to make an investigation on the spot.

TUNGSTEN IN URALS AND ALTAI.—*Ore containing considerable quantities* of arsenic, gold and tungsten was recently discovered near Cheliabinsk, in the Urals. The tungsten deposits, according to the estimates of Professor Smolin, who discovered the ore, cover an extensive area. Professor Smolin is of the opinion that tungsten ore will also be found south of Magnitogorsk and in other districts of the Urals. Recent geological investigations at the Kolivansk copper mines near Altai have uncovered the presence of tungsten ore. The ore is estimated to contain from 0.34 to 1.05 per cent of tungsten anhydride.